ITH THE BRITISH ASSOCIATION IN AMERICA (See page 227).

THE PRACTICAL TEACHER

MRS. SOPHIE BRYANT, D.Sc.

SPECIAL FEATURES
OF THE
NOVEMBER NUMBER.

WITH THE BRITISH ASSOCIATION IN AMERICA.

ENGLISH TEACHERS IN THE HARZ MOUNTAINS.

MODERN EDUCATIONAL REFORMERS: Dr. SOPHIE BRYANT.

IRON MINING AND MANUFACTURE
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·VOL· XVIII. N° 5

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THE

PRACTICAL TEACHER

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WITH THE BRITISH ASSOCIATION IN AMERICA.

BY PROFESSOR J. R. GREEN, SC.D., F.R.S.,
Examiner in Botany to the University of London ;
Late Examiner in Botany in the University of Cambridge.

THE S.S. *Parisian* of the Allan Line was chosen by a very large number of the members of the British Association as the vessel whose times of sailing and arrival were the most convenient for the meetings at Toronto. She sailed from Liverpool on August 5th, and was due at Montreal about nine days later, leaving two or three days for her passengers to recover themselves before the opening of the Association on the 18th. The members who crossed in the *Parisian* numbered about 150, and included Lord Lister, the President, Sir John Evans, the President-elect, and most of the permanent and sectional officers.

Much interest was excited during the voyage by the investigations of the zoologists, headed by Professor Herdman. Such an opportunity as the voyage afforded for ascertaining what minute marine organisms populated the surface of the ocean was too good to be lost. A current of sea-water for various useful purposes is continually being pumped up and poured into tanks on deck as the ship proceeds. By arrangement with the captain, Professor Herdman covered the outlet pipe successively with four silk nets of different degrees of fineness, and so was able to strain into four collections all that was brought on board through the stream. Thus specimens of the surface organisms were obtained continuously from Liverpool to Quebec. The nets were emptied at fixed intervals during the twenty-four hours. Very valuable information obtained in this way was communicated to the Zoological Section at Toronto.

Quebec was reached on August 13th, at about ten o'clock, and Montreal on the evening of Saturday the 14th. It is an interesting city. The streets are narrow and ill-paved, and are fearfully disfigured by the system of overhead wires. They are supported not by the housetops, but by a number of huge telegraph posts, very high, rough, and ugly. The electric tram or railway forms the chief mode of progression. The cars are supplied with electricity from a wire running down the middle of the street about fifteen or twenty feet from the ground, which is kept 'taut' by another set of wires running from it to the said posts. On a clear piece of track the car goes at nearly the rate of a slow railway train. They have a remarkable brake power, and can pull up in ten yards even from that speed. The city is largely Catholic. There are two very fine cathedrals and many churches.

On arriving at Montreal, on the Monday the Governors, Principal, and Fellows of the McGill University received the *Parisian* party with an address of welcome.

We were much interested in the magnificent engineering laboratories built and equipped by Mr. MacDonald. They are the most perfectly-appointed laboratories in existence, and the hydraulic room designed by Professor Bovey is especially interesting. Some very ingenious appliances for studying hydraulic problems were shown, *e.g.*, the experimental steam-pump, which is fitted for every requirement of research work. The McGill University gave also a luncheon and reception.

Tuesday, August 17th, was a very interesting day. On the way to Toronto, as time permitted, a party of us visited Ottawa, the seat of government. Professor Robertson, of the Agricultural Department, the Mayor of Ottawa, and other citizens formed a Reception Committee, which enabled us to see a good deal of the city in the rather limited time we had at our disposal. Ottawa is especially noted for its sawmills and for its Experimental Farm. The saw mill shown to us is the most wonderful collection of

machinery and labour saving appliances I have ever seen. The logs are floated down the river from the backwoods and a collection of guiding arrangements makes the stream float them up into the mill. They get upon rollers driven by the force of the waterfall on which the mill is built, and are drawn up into the mill by endless chains, apparently making their own way up the inclines. As soon as they are received there, they are at once rolled onto a great frame which lies by the side of the incline, and passed by machinery along to a vertical saw, which simply rips them up into planks. We saw huge tree trunks cut up thus in less than five minutes. As each plank is detached from the log it is thrown onto another series of rollers and carried away to meet other circular saws which trim it into uniform lengths.

In the afternoon we went to see the Experimental Farm. It occupies about five hundred acres, with buildings for carrying on experimental work, and residences for the chief officers. The Director with his assistant, the Foreman of Forestry, has under his charge the production of new varieties of cereals and other crops, the ornamentation of the grounds, and the plantation of timber trees. Between 1890 and 1897 a great number of new varieties of cereals have been produced at the Experimental Farm by cross-fertilizing and hybridizing. Many new fruits have been similarly produced, especially of hardy varieties likely to be useful in N.W. Canadian territory. About 400 species and varieties of trees and shrubs are being tested in different parts of the grounds, including specimens from all parts of the world where similar climatic conditions obtain. Twenty-one acres are occupied by forest belts which contain about 20,000 trees, including all the more valuable woods which can be grown there, either for timber or fuel. Annual measurements are taken of the growth of specimens of each variety. Experiments are undertaken to determine the results of placing the trees at different distances, to ascertain their relative growth when planted in blocks of single species as compared with mixed clumps. The value of tree belts for shelter is being investigated and the most suitable trees and shrubs for hedges are being tested by the planting of trial hedges of fifty feet in length. Another important work under the special charge of the Director consists in permanent test plots for gaining information as to the action of fertilizers on important crops, 105 plots are now devoted to this work. In the seed-testing house and conservatory the germinating power of doubtful samples of grain and other agricultural seeds is determined, and the information given prevents, in many cases, the sowing of seed with inferior germinating power. The best and most productive varieties of grain grown on the Experimental Farms are annually distributed by mail, free, in bags containing 3 lbs. each, to farmers in all parts of the country who ask for them. These samples of grain when sown and properly cared for usually produce from one to three bushels, and at the end of the second year the grower has generally a sufficient quantity of seed to sow a considerable acreage.

The Farm Agriculturist conducts the feeding experiments with cattle. They have for their object the showing of the most economical rations for the production of milk and beef. Ensilage of Indian corn has thus been shown to be economical in the winter feeding of cattle. He has, too, the charge of the Dairy Department, and superintends experiments in butter making. He also tests varieties of Indian corn, roots, hay and other fodder crops, as to their relative productiveness, and the value of different fodder plants and combinations of fodder plants as food for stock.

The Farm Horticulturist tests the value of a large number of varieties of fruits at the farm, tries new varieties of fruits to determine their hardness and quality, and tests the best methods of culture. He also experiments on fungus pests and carries on a large correspondence with horticulturists in different parts of the country.

The Farm Botanist and Entomologist investigates the life histories of injurious and beneficial insects, the value of various native and imported grasses for hay and pasture as well as other fodder plants. He also gives special attention to the subject of noxious weeds and their eradication and conducts experiments in connection with bee-keeping. Many collections of plants and insects are sent to him every year for identification.

The Farm Chemist analyzes fodder crops to ascertain their feeding value at different stages of their growth, examines the naturally recurring fertilizers of Canada with a view to their practical use, examines water supplies, and carries on a large correspondence with farmers about the treatment of soils, the fertilizers they should use, and the relative value of cattle foods, etc.

There are at the Farm 65 acres of land forming an interesting Arboretum and Botanic Garden. Special attention has been devoted to obtaining as many of the trees and shrubs native to Canada as possible, and such species and varieties from other countries as are likely to prove hardy there. In the Arboretum there are about 2,000 trees and shrubs and nearly 1,100 perennial plants. They have been arranged as far as possible in related botanical groups for purposes of convenient comparison and study.

As a consequence of the visits made to the Experimental Farm, Section B, Chemistry, passed an important resolution: 'That the Council be requested to consider the desirability of approaching the Government with the view of the establishment in Britain of experimental agricultural stations similar in character to those which are producing such satisfactory results in Canada.'

About twelve hundred members and associates of the British Association assembled at Toronto were formally welcomed on Wednesday, August 18th, by the Governor-General of the Dominion and the Mayor and Council of the city. Several foreign men of science, including Dr. Anton Dohrn of Naples, and Professors Minot, Newcomb, Osborn, Putnam, Runge and Ira Remsen were present at the meetings of the Association. Many Canadian scientific men also took part in the proceedings and the opening meeting was held to be a great success.

On Thursday, the 19th August, most of the Presidents of the various sections delivered their addresses, and an evening reception was held in the Parliament Buildings of the Province of Toronto.

On August 20th honorary degrees were conferred by the University of Toronto on Lord Lister, Sir John Evans, and others.

The city of Toronto is nearly as large as Montreal, and is arranged in something of the same manner.

BRITISH MUSEUM

The streets mainly run at right-angles to one another, giving an appearance of almost severe regularity to the place. The main streets have electric tramways along them, and these form the chief means of transit from place to place. Cabs and other vehicles drawn by horses are very seldom seen. There are two or three very fine parks. In the chief one the Parliament buildings and the University are situated. The University buildings have a very fine appearance, standing in the centre of the park at some distance from any other structure. The main front faces south, and shows a large central tower with two long wings. Two other wings project backwards towards the north, one on the west and the other on the east side. Separate buildings at some little distance are devoted to biology and engineering. The former contains a small but well-arranged museum.

Toronto has another University known as the University of Trinity College. This is smaller, and is sectarian in its aims. Wycliffe College, a training college for theological students, stands not far away. This was made the headquarters for the Secretaries of Sections.

The fact that during the meetings of the week all the sections of the Association were sitting concurrently renders it impossible to speak in detail of the general work. My own predilections were naturally towards the three biological departments—Zoology, Physiology, and Botany. Professor Michael Foster's presidential address to the second of these was one of the features of the meeting. It was a masterly review of the progress of physiology since the Association met at Montreal in 1884. Almost equally interesting was Professor Marshall Ward's discussion of the position of Botany at the present moment, including as it did a review of the lines which modern research is taking and a forecast of the important practical applications now being foreshadowed.

A detailed account of the proceedings of the sections would hardly be appropriate in the present article. Interesting and important contributions were made by both English and American writers, and no small advantage accruing from the meeting has been the cordial friendships that the week saw formed and developed between men whose opportunities of seeing each other have been small and infrequent.

Education in Canada is by the British North America Act assigned to the provincial legislatures, with the reservation to the Dominion Parliament of the right to intervene for the protection of the rights of religious minorities. The Quebec system of education comprises the Department of Public Instruction, at the head of which is a superintendent, and for administrative purposes a Council of Public Instruction, divided into a Catholic and a Protestant Committee. All the Catholic bishops of the Province are members of the Catholic Committee, and there are 4,727 Catholic schools. The Protestant schools of the Province are 955 in number. The total average attendance of pupils in all the elementary schools, both Catholic and Protestant, was 214,960 out of a total of 284,047 enrolled. The Universities of Quebec are the Catholic University Laval in Quebec, McGill University (non-denominational) in Montreal, and Bishop's University (Anglican) in Lemonville.

The educational system of Ontario is under a Minister of Education, with an Educational Council to conduct all examinations prescribed by the Education Department for the pupils of elementary and secondary schools. There are 5,649 elementary schools in the Province, including 328 Catholic separate schools and 10 Protestant separate schools. Out of 493,063 pupils on the books there is an average attendance of 272,211. The secondary school system is entirely non-denominational and undivided. There are 129 secondary public schools and 90 Kindergartens. In the professional training of teachers in Ontario there are 60 County Model Schools, two Normal Schools, and a Normal College. The Province has six Universities, of which only one—the University of Toronto—is a State institution. The others are Victoria, which is federated with Toronto, Queen's University at Kingston, Trinity at Toronto, McMaster at Toronto, Western University at London, and the University of Ottawa.

The Manitoba system of education is under a Superintendent and undivided Council of Public Instruction. In 1895 the average attendance of elementary pupils was 19,516. There is but one University, which is maintained by the Province.

Nova Scotia has 2,305 elementary schools and several Universities. St. Francois Xavier College and St. Anne College are Catholic; King's College, Anglican, and Acadia University, Baptist; Dalhousie University is undenominational, but receives the support of the Presbyterians.

The Province of New Brunswick possesses 1,695 elementary schools, 13 County Grammar Schools, and maintains the University of Fredericton.

The Province of Prince Edward Island has no University. It has 450 elementary schools, and for secondary education there are 20 High School Departments attached to elementary schools, and one Provincial High School, which supplements these departments.

One of the most interesting of the excursions undertaken in connection with the Toronto meeting of the British Association was a visit to the Falls of Niagara.

Leaving Toronto by boat at nine o'clock on August 21st, we crossed Lake Ontario to Lewiston and took the electric cars up the gorge to the town. The rapids are wonderful, and the whole gorge, cut in the past by the fall as it has gradually worked backward, is very imposing. The falls at first sight disappointed me. The most impressive spot is at the bottom of the fall at the entrance to the Cave of the Winds. Looking up at a mass of falling water 160 feet or so high, and seeing the impact on the rocks with the resulting spray, makes one realise what is really happening. It is only close to that one sees the size of the thing. Before going through the Cave of the Winds we were instructed to strip and put on a costume furnished us. It began with pyjamas and ended with oilskins. A party of us, about six in number, marched down a long, circular tower, and made our way to the foot of the fall. The thick canvas shoes which were given us to wear prevented our slipping. On passing in front of the fall, for a short distance we were met by the spray in blinding showers. When we cleared our eyes sufficiently to see, the scene was majestic. The sun, shining brilliantly on the spray, produced rainbows wherever we looked. Sometimes they were complete circles. We groped our way round the front of part of the fall and went into a kind of cleft in it, where it was broken in two by a small island at the

top. The so-called Cave of the Winds is the passage behind the small piece so cut off. On getting behind this sheet of water we were made to form a line by holding hands, and then, facing the rocky background, we sidled along a path about 3 feet wide, with the water thundering behind us. The force of the water falling made it truly a Cave of the Winds. There was a regular hurricane blowing, and the spray from the downfall and that carried up by the wind made it impossible to turn one's head to the fall. The passage was short, but exciting. There is, however, no danger about it, for the path is a good width, and the canvas shoes make slipping impossible. It tries your nerve a little, for if you turn your head to the fall you lose your breath as promptly as if you put your head in a bucket of water. The voyage in the little boat, the 'Maid of the Mist,' is very exciting. Its course follows the curve of the horseshoe, and the fall is seen towering almost vertically above. The boat rocks a good deal, and the spray is drenching.

After the meetings of the Association were over, I visited the Botanical Departments of some of the U.S. Universities, spending on my way to St. Louis three days at Chicago, and a day with the Professor of Botany at the University of Minneapolis.

St. Louis has the most famous Botanic Garden in the States. The Director, I found, had been obliged to go away, but his deputy very kindly made me at home. The founder, Henry Shaw, besides founding the Garden in 1857, in 1885 endowed the Henry Shaw School of Botany in Washington University, St. Louis.

The Garden, with its greenhouses and Arboretum, is open to students of the School of Botany for all necessary purposes of study. The Garden proper is very pretty, and covers about nine acres. The Arboretum occupies about twenty acres, the Fruticetum eight acres, the Vegetable Garden three acres, and the Lawn about two acres. The plants are extremely interesting, the open air ones especially being very different from what we get in England. There is a most lovely water-lily pond, containing gorgeous specimens of these aquatics. Some of the leaves of the Victoria Regia lily there have been found capable of bearing a weight of 4 cwt.

On Thursday morning, September 3rd, I left St. Louis for Washington, and arrived there on Friday afternoon. The journey over the Alleghany mountains was most charming. The road winds up to a height of 3,000 feet and then descends. High mountains clothed with trees to their summits slope down on each side forming grand ravines, at the bottom of which flows the Potomac. The line goes by the side of the stream.

Washington is a very striking city. In some respects it reminded me of Westminster, and in others of the Italian cities. It is very quiet and orderly. The cars are driven by cable traction. I was much interested in the Capital and the great new Congress library which has just been built, and which is to be the finest in the world. It is certainly very gorgeous.

From Washington I went on to New York, arriving there on Saturday, September 5th. It seemed to me the most homelike of the American cities I had seen, reminding me in many particulars of London. One of the most interesting things I saw there was the Botanic Garden now in course of formation. The Director, Dr. Britton, is the Professor of Botany at Columbia College. The Gardens will have an Arboretum attached to them, and special attention will be devoted to the School of Forestry in connection with the Gardens. A Botanical Laboratory is to be started as soon as possible.

The general course of scientific teaching both in the United States and Canada is very much the same as that practiced in England. This is especially the case in the botanical departments. The text-books in use are on much the same lines as our own, and about the same amount of time is devoted to laboratory work. Perhaps the greatest difference is seen in the amount of original investigation which is carried on. Here England takes easily the premier position. The laboratories and their equipment are, however, far better in America. Money appears to be more plentiful, and the possessors of it more liberal or more public-spirited than on this side the water. The result makes an average Englishman envious, till he recovers his spirits with the thought that very often the equipment and the results derived are in inverse proportion to each other. But with a number of ardent students backed up by capable professors there is little doubt that American research will make a name in the not very distant future.

INTERNATIONAL CORRESPONDENCE FOR TEACHERS.

LEARNING A LANGUAGE BY LETTER-WRITING.

OWING to special pressure on our space this month, our notes on this Correspondence must be very brief. We wish, however, to acknowledge the letters of grateful appreciation we have recently received from several of our readers who have entered into the scheme.

One lady writes rejoicing not only in the extreme suitability of her French correspondent, but also in the fact that by some means a second has been paired with her. The result is that her opportunities of practice are increased with a greater variety of interest.

Another correspondent is so pleased with the arrangements made, that she asks if we can manage to secure for her a second correspondent. This, we think, we cannot in perfect fairness undertake to do, but we would suggest that through her present correspondent our friend might find it possible to arrange privately for another.

From the representative of MM. Armand, Colin et Cie, we have received an explanation of the delay which has occurred in some cases. On account of exceptional pressure, lists of names prepared for publication in certain numbers of *Le Volume* were crowded out of its columns. This has now been remedied, and it is hoped that the correspondence arranged for has come into operation, and that such delay will not again occur.

In some cases correspondents did not see until the end of the long vacation the lists in which their names had been published some weeks earlier. This, of course, delayed their first communication.

The teacher of a Higher Grade School has sent us a long and interesting account of a plan which she has pursued for her more advanced pupils to carry on a systematic correspondence with an equal number of French school-girls. She describes the enthusiasm with which the pupils enter into this enjoyable work. We much regret that we have no room at present to print this encouraging experience. We mention it, however, because we believe that in many of our higher grade schools connected with School Boards and other organisations, such a plan might be adopted with the best results. We earnestly recommend teachers of higher grade boys' schools to give the plan a trial. Names of scholars should be sent to Mr. Stead, office of *Review of Reviews*, who will gladly supply any information required.

VISITS OF INSTRUCTION.

VIII.—IRON MINING AND MANUFACTURE.

IT was my pleasure during a recent holiday to visit the Cleveland district, and, in company with a friend, to walk through some of its pretty villages. As we passed through one village we noticed one or two houses, apparently substantially built of stone, deserted, and their walls gaping with great cracks from top to bottom. We attributed this to faulty foundations, and thought no more about it till, after a further walk of a mile or two, we came to what appeared in the distance as the very paradise of a country village. Situated on the southern slope of a hill, sheltered from the north winds and yet enjoying the refreshing breezes from the adjacent sea, it overlooked a fertile and well-wooded plain, and the horizon southward was bounded by the higher Cleveland Hills. The cottages were of stone, most of them built in the semi-detached style with gardens in front. In the distance they seemed to have scarcely lost their newness, yet on reaching the village we were surprised to find house after house uninhabited, the windows and fanlights being boarded up and large beams reaching from ground to eaves bolted through to the inside

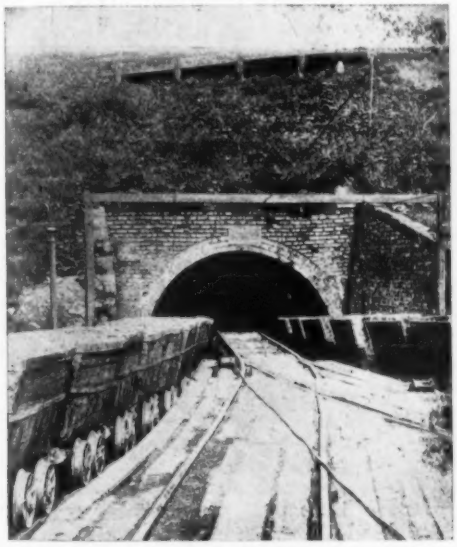


FIG. 1.—Drift entrance.

and supported by others leaning against them. As far as we could see, they seemed to be in perfect condition. It might almost have been called a deserted village. We saw one of the villagers, who, in answer to our enquiry, informed us that the ground had given way on account of the ironstone having been taken out. Some other houses, still occupied, were going to be tested the following week, and probably they also would be condemned as not being safe. The Primitive Methodist chapel was also boarded up, but the Wesleyan chapel, church and vicarage were still all right. We learned afterwards that this was because the ironstone was left undisturbed for a certain area underneath the above-mentioned buildings, and as one or two houses were also on this area they were safe, but far more houses were deserted than inhabited.

Having thus seen the outward and visible signs of a great work going on beneath our feet, we surmounted the hill, and descending the other side we saw the engine-house and other buildings belonging to the outside works of a mine. The outsides of these mines are not such ugly blots on the beauty of the landscape as coal pits are. There are none of those great, unsightly heaps of shale and rubbish. In making the entrances into the mine a considerable quantity of earth has to be taken out, but in most cases this soon gets covered with grass, giving the appearance of little green, rounded hills.

Some of the mines are entered by a shaft, as is usual in coal mines; but in the mine we were allowed to look over we entered by a 'drift entrance.' Such an entrance is shown in Fig. 1. As in coal-pits there are two shafts to secure ventila-

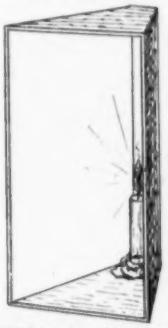


FIG. 2.—Midge, for holding the candle.

tion (see THE PRACTICAL TEACHER, May 1897), so there are two drift entrances—one called the *wagon drift*, used for haulage purposes, the other the *travelling way*, used by the miners to enter and leave the mine. Only overlookers are allowed to enter by the wagon drift, but as we were under the guidance of one of the foremen, we entered it. This had an incline downwards of 1 in 30. The road was good, wide, and high, but here and there were *refuges* or places into which anyone could get to be out of the way of the wagons. The light from the entrance shone into the drift for a long distance, but at length we lost sight of it, and had to find our way entirely by the candles with which we were supplied. We carried them as the miners do, in little wooden boxes called 'midges,' the candle being fastened in with a lump of moist clay. Of course there is not the danger from gas explosions which is ever present in coal mines, hence the naked light is used.

We soon reached a place where there was a bench, on which the men sit to 'get their sight,' that is, until their eyes get accustomed to the gloom. A little further still the passage widened out, and on a board posted up we could read 'Meeting Place.' Here the workmen, who have entered by the travelling way, have to sit on benches placed around till a deputy comes

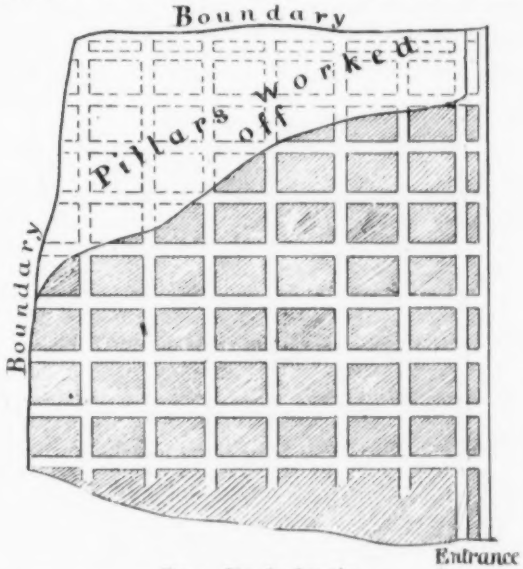


FIG. 3.—Plan of an Iron mine.

to meet them and gives them leave to go forward. He must have entered the mine at least an hour before the men to examine the roof, or to see if there is any danger from water, foul air, or defective ventilation. He makes his survey,

tapping the roof all about the workings with a stout stick armed with iron. He knows by the sound if there is likely to be a fall. Having thus examined the mine, he meets the

FIG. 4.—Hydraulic boring machine at work.

underground manager in a small room, makes his report in books there provided, and then goes to meet the men.

We were taken to the farthest part of the mine first. As we went along we saw passages leading off at regular intervals of about 22 yards at right-angles to the main headway. Passages parallel to the main way intersect these, and thus cut up the mine into rectangular blocks. Figure 3 shows the method of laying out the mine. They begin making these passages and parcelling out the stone into pillars from the entrance towards the boundary till the whole tract is thus marked out.

They get the ironstone partly by direct hewing with the pick, but more generally by blasting. Bore-holes are made into which cartridges with fuses are inserted. The bore-holes are in some mines made with hammer and chisel by hand labour, in others machines worked by air (pneumatic) or water (hydraulic) bore the holes into which the miners put their

FIG. 5.—Winding machinery.

cartridges of compressed powder. The large pieces broken off by the blasting charge have to be broken up into such pieces as a man can lift. When thus broken up the ironstone is thrown into wagons holding about two tons. These are shown in Figs. 1 and 6. The men are paid according to the amount of material they get. As a rule two men work together. A number is attached to the wagon, and it is known at the surface what men are filling wagons of that number. When full, large horses draw them to a point where several are joined together. The train of trucks thus formed is drawn to the surface by a wire rope wound round a large drum, as shown in Fig. 5. The rope is guided by wheels and rollers. Two of these may be seen in Fig. 1. When the wagons reach the surface they are weighed, the number being taken off, and the weight entered to the credit of the men to whom the number belongs. The weighing-house, with a large number of tickets for attaching to the wagons hung up on one side, is shown in Fig. 6.

The stone in the mine we visited was about ten feet thick, yielding about ten tons per superficial yard. It is the carbonate of iron, lightish grey in colour, and yields about 30 per cent. of iron. When the passages have been driven as far as the boundary, the men begin hewing out the pillars, beginning with those in the most remote part of the mine first. The roof around where the miners are at work is supported by props made from young trees, generally fir. It would be unsafe to cut away a whole pillar—about 22 yards square—as the pressure of the roof where the stone has been removed is enormous. It would be impossible to support an area as great as a whole pillar, so a portion only is removed at a time, the roof being carefully propped as the work proceeds. Even then the props are shattered and bent in all directions. Our guide told us

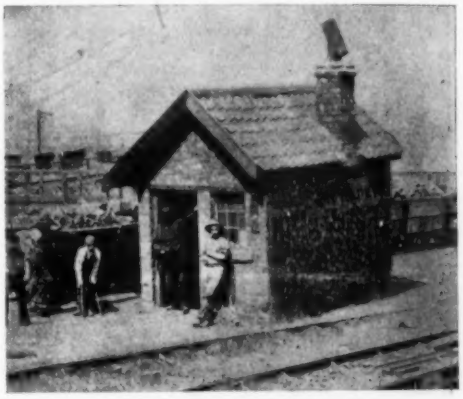


FIG. 6.—Where the ore is weighed.

that the pillars always give warning by loud cracks before the roof gives way. He kept us talking for some little time amidst this little forest of props, and soon there was a tremendous crack close to our elbows. We were both ready to run, much to the amusement of our guide. Then as we moved on the cracking became general, and to say the least, it was a little disconcerting to those who are not used to it. But I suppose it is much worse than we found it, before the roof falls. When as much space has been cleared as they dare leave supported by props, the men have to 'let down the roof,' that is, cut or saw the props away, and the roof then falls. This part of the work is the most dangerous. As the farthest columns are removed first, the workmen are always working towards the entrance of the mine. It will be interesting to compare this mode of mining with the method of coal-mining described in the May number of THE PRACTICAL TEACHER. Many coal mines are worked on this system also.

Having now described the method of mining the ironstone, let us follow it through its various processes up to the steel rail or girder. If the ore is carbonate of iron—like the Cleveland ironstone—it must first be *roasted*. This used to be done by building it up in large heaps and mixing it with small coal. The process is now considerably hastened by roasting it in kilns not unlike those for burning limestone. These roasting kilns, or ovens, may be seen in great numbers along the railway line from Middlesbrough to the heart of the

Cleveland mining district. In these kilns carbon-dioxide is driven off, the carbonate being thus converted into the oxide. If the ore is an oxide like *hæmatite* and *magnetite* to begin with, this process is omitted. The ores lose from one-third to one-fourth of their weight by this process.

The next process is *smelting* in the blast furnace. The modern blast furnace is a very different structure from the old type. Those we saw at work were 65 feet high. They appeared cylindrical from the outside, but in section they would appear as double cone-shaped in the middle, lined with firebrick and encased in iron plates. We were first taken to the back of the blast furnaces, where men were weighing the charging materials in iron barrows. The substances were coke, limestone, and ironstone. The mixing of the materials affects the quality of the pig iron produced, hence all the quantities are weighed. The barrows are run to the bottom of a hoisting shaft, midway between two blast furnaces. On the signal being given the load is hoisted to the gallery at the top. We took our places on the hoist instead of barrow loads of material, and were straightway raised to the top to watch the charging operations. The old form of blast furnace was open at the top, and long tongues of flame darted upwards. Now the top is closed by a hollow iron cone, point upwards, and its circular base just fitting the top of the furnace. The object of this is to prevent the escape and combustion of the inflammable gases produced in the blast furnace. Instead of burning at the top of the furnace, they are now led away and utilised as shown below. The men empty about six barrow loads of the charging materials (two of each substance) into the depression around the conical hopper. This is then moved by machinery, and the charge drops evenly distributed into the furnace. During the short time that the top of the furnace is open to admit the charge, there is a large outrush of gas. Immediately over the top of the furnace a fire is suspended, and this ignites the gas which escapes, if any comes out unconsumed. The hopper then again resumes its position. The men throw in small quantities of fine material like ashes to fill up the small openings through which some gas escapes. As the barrows each hold about 13 to 15 cwt., it follows that at each charge about four tons of materials are lowered into the blast furnace.

The gas which used formerly to burn at the top of the furnace, is conducted by large tubes into Cowper stoves and there burnt. The stoves are about 75 or 80 feet high, and are lined with fire-brick, which gets white hot. As soon as one stove is properly heated, the gas is turned into another similar one, and air is forced through the first heated stove up one side and down the other, and thence into the blast furnace. In Fig. 7 the iron tube conveying the hot blast to the bottom of the blast furnace is shown on the left of the figure. This

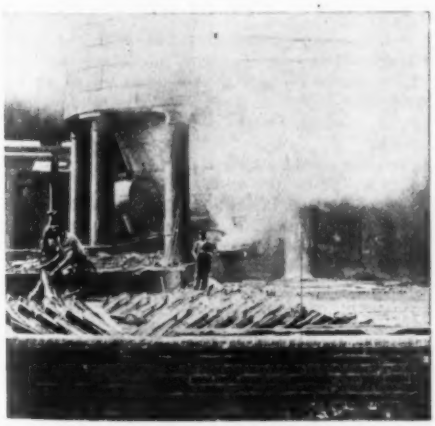


Fig. 7.—Blast furnace. Casting the pigs.

tube is generally red hot, but this is not to be wondered at when the air brought along it is from 1,200° F. to 1,500° F. The saving in fuel effected by this hot blast is enormous. Besides being utilised for the hot blast, the gas also heats 16 boilers which were formerly heated with coal, each boiler consuming 11 tons per day. The pipes or 'twyers' which bring the blast to the furnace are kept from melting with the great heat by being made of a double casing with water circulating between.

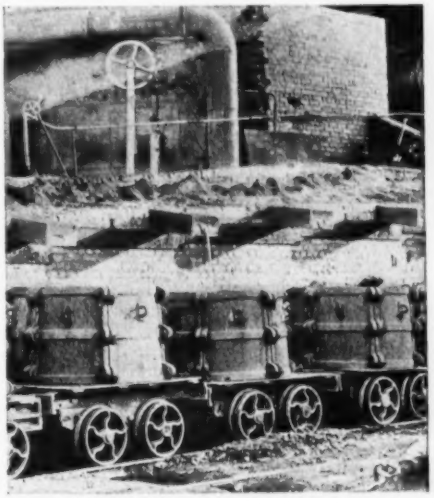


Fig. 8.—Running into Iron moulds.

The molten material falls to the bottom of the furnace, but the slag being lighter floats on the top of the iron. It runs out of an opening a little higher up than the one through which the molten iron runs, and is conducted down channels into large iron moulds, as in Fig. 8. Then it solidifies on cooling. In the works we visited, the slag was broken up by stone-breaking machines, and sold for road making or concreting. The blast furnace is tapped every four hours. The molten stream of iron is conducted into a series of moulds in sand, being directed into the farthest ones first. The liquid stream is shown in Fig. 7 running into the moulds on the right. While the iron in this set of moulds is cooling, they prepare another set for the next tap. Sand is spread over the cooling iron, and cooling is hastened by playing upon it with a hose pipe. In Fig. 7 on the left the men are busy taking up the pigs which have thus been cast. The average weight of an ordinary pig is about 16 to the ton, and from 250 to 300 pigs are cast at every tapping of the furnace.

We were next taken to that part of the works where the pig iron is converted into steel by the Bessemer process. Before leaving the blast furnace we were taken to see a large *ladle* filled with molten iron from the blast furnace, in a manner very like that shown in Fig. 8. It is the same iron as is used in casting the pigs, but the first portion of the stream is run into the ladle, and this is conveyed by a little engine to the Bessemer converter. The blast furnaces are not able to keep the four converters going, so a considerable quantity of pig iron has to be bought. If the iron from the blast furnace has been allowed to solidify into pigs, these must be again melted. This is done in a little furnace near the converters, called a *cupola* furnace. About from 9 to 12 tons of molten pig iron are put into the converter, and a blast of air sent through. There is not much action at first, but soon there is a most brilliant flame from the mouth of the converter. When the blast has been going through for about twenty minutes, a quantity of white pig iron is added, which contains sufficient manganese to unite with the silica still in the iron, and sufficient carbon to convert the iron into steel. It is then cast into large ingots. 24 cwt. of pig iron will make a ton of steel. The four converters we saw at work turn out 200 tons of steel per shift of twelve hours, and the blast furnaces produce 1,800 tons of pig iron per week.

The steel ingots are again heated in a furnace, and are then passed between huge rollers. At first the ingot is about a yard long and a foot square. When it has been once through the rollers it is longer and thinner. It comes back

through a part where the rollers are still closer, and is thus made still longer. If a steel rail is to be made, the final space in the rollers is shaped like Fig. 9*a*. ; if a girder is required it is shaped like Fig. 9*b*.

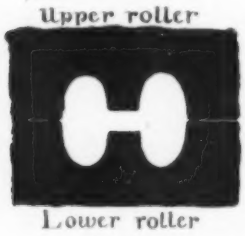


Fig. 9*a*.

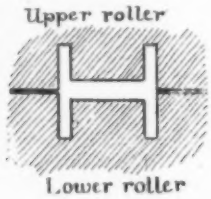


Fig. 9*b*.

The work of passing the white hot ingots through these rollers seems the most arduous of all the processes. The heat given out from them is intense. The men have green glasses supplied, but they generally prefer to shade their eyes with their hands alone. They manipulate the masses of steel with long pincers. The long rails, girders &c. thus formed are run on rollers to a circular saw, which cuts them up into the required lengths, seemingly as easily and quickly as wood is cut, but with the production of numerous bright sparks, flying in all directions.

Before leaving the works we were taken into the testing rooms. A little portion of each cast from the blast furnace is analysed, and a portion of steel from each converter is also analysed and tested for strength, bending capacity, &c. This ends the processes in the production of the raw material. We afterwards saw the cast iron and steel made up into all kinds of machinery ; but, as space is limited, further processes will for the present be omitted.

ENGLISH TEACHERS IN THE HARZ.

BY MISS CATHERINE I. DODD,
Author of 'The School Journey in Germany' in Education Department's Special Reports on Educational Subjects 1896-1897.

THE chief troubles of our life arise from the fact that mortals never know when they have had enough ; we always want more, and when we cannot get it our sorrows begin. This desire to grasp more arises early. A bright girl of thirteen once lamented that she had never in her life had enough of anything—'except examinations,' she sorrowfully added as an afterthought.

Just so with the lively party of Englishwomen, students and teachers, who came out to the ideal holiday course. When the lectures were over and the notebooks closed, they decided that they had not seen enough of Germany, and they determined on sightseeing before returning to England ; but the old difficulty stood in their way—want of money. However, they were cheerfully optimistic, and they declared that money was only secondary in the affairs of life.

One brilliant Optimist persisted that travel costs nothing if one only knows how to do it. She claimed to have had some experience, and she pointed out that with one's possessions on one's back, and an umbrella instead of a staff in one's hand, one could do the journey on foot, and so save the expenses of transport. She further affirmed that if one went off the track of the great tourist throng, and slept at primitive inns and lived on simple fare, the cost of one's nightly shelter and daily bread was reduced to almost nothing. The others cheerfully listened to these enticing fables, and a walking tour in the Harz was sketched.

The first matter was to provide packs. The Optimist purchased a green canvas sack with straps to go over the shoulder. She paid two marks for it ; the price was reduced because it had long hung outside the shop and had become faded in the sun. The Samaritan of the party, who always looked after other people, bought a brown canvas pack which strapped over the shoulders ; it was elegant and spick-and-span, but it cost three-and-a-half marks, which the Optimist considered was an extravagant price. The two students paid 75 pfennigs (about 9d.) for an American leather bag ; they said that this and a strap would hold their possessions.

The Typical Englishwoman, who was supposed to represent her nation on account of her exclusiveness and sobriety, bought nothing ; she said she had a Japanese basket which would do, and the Girtonian rose superior to us all, for she possessed a real brown canvas and leather sack, which had already done service in Switzerland and the English lakes.

The Optimist sadly compared her green sack with the superior brown one of the Girtonian, and admitted its inferiority ; but she was comforted when the two students assured her that faded green was a picturesque colour, and that she looked like somebody in the Bible, or like Christian with his load of sin, when she had it on her back.

The party did not all start together, for the Girtonian was impatient to see a great deal, so she started alone two days before the rest, and it was arranged that they were to meet her later. Then the two students pined to see Eisenach and the Wartburg, so the Samaritan determined to go with them, and after spending a day and a night there, to meet the rest of the party at Erfurt on Monday morning *en route* for the Harz.

Only the Optimist and the Typical Englishwoman left Jena early on the Monday morning. The latter had strapped a light basket on her back which seemed to contain an extensive wardrobe, among other items, two changes of blouses and a clothes-brush. The Optimist thought this was sinful luxury.

At 9.30 the two travellers met the Samaritan and the two students at Erfurt, but trouble had befallen them ; one student had walked the soles off her shoes at Eisenach, and she stood there in smiling contentment in the dancing slippers of the other student. Shoes must be bought, so the Samaritan bore her off to a shop, where she bought canvas shoes for three marks, while the Typical Englishwoman went to look at the Cathedral and the Optimist studied railway fares. She discovered that 4th class fares cost less than half the 3rd class fares, and decided to travel 4th class immediately.

Trains may be slower in Germany, and the carriages less comfortable, but the great defect of our system is that we have no 4th class. An American philosopher who had studied psychology in Germany once told me that he had learned 'more psychology in a 4th class railway carriage than in a first-class lecture.' He said, 'One sees such peculiar combinations of soul and body among the peasants—a kind of naive nude in a civilization that has made a fad of drapery.'

We excited interest among the 4th class company, and our conversations were amusing. The Optimist was struck with the intelligence and the elegant head gear of the German chimney sweeps, while the Typical Englishwoman made friends with the babies.

At Frankenhausen we found omnibuses going to the Kyffhaüser. The cost was one mark, and we were flushed with the virtue of our 4th class economies, so we indulged in the two hours' drive. It was a beautiful road, winding up and up the hill, through forests of pines, beeches, and birches to the summit.

The ancient castle, which was once occupied by the Hohenstaufen, is on the height, and tradition says that the Emperor Barbarossa slumbers beneath in the bowels of the earth.

It was nearly three o'clock when we reached the inn at the summit. We had not eaten since a light breakfast of rolls and coffee at 6 a.m., and we were half famished. Castles, landscapes, ancient traditions were nothing to us. We went straight to the inn and ate and drank. The waiter could not supply us with bread fast enough. "This Germany!" grumbled one of the students, after the fifteenth roll was despatched, and no more white bread was forthcoming ; but the Samaritan and the Optimist went on munching the black bread cheerfully.

After the meal, we adjusted our packs and walked through the forest to the ruined castle of Rothenburg, and from thence to Kelbra.

It was evening when we reached the little railway station, and we drank coffee and considered our plans. The Optimist declared that the Hexentanzplatz and the Bodenthal were the

most beautiful parts of the Harz, but the students who could only spare two days had set their hearts on the Brocken.

The Samaritan cast in her lot with the students, and they departed in a 4th class carriage, en route for the Brocken, while the Optimist and the Typical Englishwomen waited for another train to Stolberg, and in the interval they walked in the rye fields of Kelbra and watched a glorious sunset.

They reached Rottleberoda at 10.30, and found they were some miles from their destination. A kind of primitive waggon stood outside the station gates, so they climbed on to the front plank beside the driver and listened to the eager prattle of the market women inside the coach. One woman had a basket of live geese, which cackled continuously, and one restless bird kept plucking at the Optimist's sleeve during the whole journey.

They drove on in the dark night through the Tyrathal—this was described in the guide-book as being exceedingly picturesque—and they deplored that there was nothing to be seen but the dim outlines of dark trees and rocks on either side of the road, while the sound of rushing water and the cackling of geese disturbed the still night.

At Stolberg the two travellers soon found a suitable inn, and after a meal of cocoa and eggs they retired to the quaint bed-room with its impossible wall paper and curious German beds.

In the morning they were wakened early by the splashing of water, the cackling of geese, and the tinkle of cow bells. From the window they saw the fountain on the market sending forth streams of water from quaint Dragon's Mouths, while flocks of grey and white geese stepped solemnly around. Presently the tinkle of the cow bells became clearer and whole herds of black, dun, and white and red creatures came trooping through the street to the milking place. Later, herds of goats came along, stopping sometimes at the fountain to skirmish playfully with the stately geese.

At 7.30 the two pedestrians were quitting the picturesque little town, stopping occasionally to admire the antiquated, dark-timbered houses with the curiously-carved doors and balconies. They took an upward winding path to the Joseph's Höhe. At the summit, they climbed the tower and obtained a fine view of the country, with the miles of beeches and pines and the winding valleys. Then they plunged into the cool forest, and after an hour's walk came out into a dusty road. The sun beat fiercely upon them, their packs became heavier, they were parched with thirst, and disturbed by the bites of gnats; but on and on they went, until they discovered they had missed their way. A white-haired old man, who was mending the road, directed them to cross the upland fields, rich with the yellowing corn, and occasionally varied with potato fields and patches of maize.

The Optimist was cross and dusty, and the Typical Englishwoman was silent and tired when they reached the tiny wayside station, thronged with peasants and one or two tourists. The train was just in the station, so they had barely time to secure 4th class tickets, and the hope of a drink had to be relinquished.

They secured hard wooden seats, and made cushions of their packs.

The Optimist fell asleep immediately, and dreamed of cooling streams, and the Typical Englishwoman exchanged views on roads and routes in the Harz with two tourists, who had also lost their way that morning. Then the Optimist woke up and contradicted everybody. She seemed to think that the Harz maps were stupid, and the highways terribly exposed to the sun. She also thought that the trains were inconsiderate, as they did not wait for the late tourists to quench their thirst in the wayside stations. The complainings of the Optimist were interrupted by the arrival at Gernrode.

Here they stepped out and had a meal in the railway station. The landlord recommended the veal cutlets. So these dainties were served browned and crumbed, garnished with salad and oil, compot, and fried potatoes. White rolls, butter, and slender glasses of cool lager beer were the accompaniments.

For two hours they sat in the station balcony looking over the cornfields. The Typical Englishwoman became restless and wanted to get on further, but the Optimist discoursed on the beauty of repose. She said it was a restless age, and mortals were not content to sit and silently enjoy Nature. The Typical Englishwoman urged that Nature was lovelier higher up. The Optimist said that discontent with what one had was the prevailing evil of modern life.

It was half-past four o'clock when the Optimist unwillingly consented to shoulder her pack and climb up the Stubenberg. In half-an-hour they reached an inn, and the Optimist insisted upon resting there and having tea. The view was considered to be the most picturesque in this region of the Harz, and she said that one must take in the details of a fine view leisurely. The tea was refreshing, and the view was certainly worth examining.

At half-past five they began to ascend the winding wooded path to the Lauenburg. They went slowly, admiring the changing view, examining the map at intervals, and identifying the distant hills and landmarks. There was a tender evening glow over the landscape, and gray mists and soft cloudy skies, which sometimes threatened rain, until the sun broke out and dispersed them.

Lauenburg is a ruined castle, commanding a magnificent view. They found a simple inn on the summit, and secured beds for the night. The evening meal of eggs, milk and black bread was very delicious and very cheap. The accommodation was primitive, but the weary tourists slept profoundly the healthy sleep of the out-door toiler. They were very tired.

The Optimist declares that the second day of a foot tour is always the worst. The first day the novelty tends to keep one's spirits up, and the third day one's muscles become accommodated to the strain, but the second day necessarily entails some loss of temper and weariness of flesh.

At 8 o'clock the third day the two started with light hearts for the Hexentanzplatz. It was a magnificent morning; the forest ways were dewy and dainty with delicate flowers. The air on the breezy heights was fresh and bracing. Their packs had accommodated themselves to the muscles of their backs, or *vice versâ*, and gave them no inconvenience, and they trod the heathery paths gaily.

The Optimist insisted on composing German poetry. She declared that the forests of Germany were responsible for all the admirable qualities the people possessed. Germans were a poetic nation because the forests inspired them with poetic fervour; they were a religious nation because the forests were vast cathedrals, and one's natural impulse was to worship there. They were a race of philosophers because the forests fostered reflection; they were a race of scholars because they found 'books in trees,' and they were a race of pedagogues because they learnt wisdom and patience from the forest.

The Typical Englishwoman remarked that they were also a race of soldiers, but the Optimist replied that an accident of government made them soldiers, but the forest made them Germans. The Optimist wrote her poems on the margins of the maps, and the Typical Englishwoman suggested grammatical corrections. The style of the poems was decided to be an imitation of Heine, but the sentiments were according to Schiller.

Discoursing on these lofty themes the two reached the Hexentanzplatz. This is a wonderful rocky plateau, 1,521 ft. in height; it stands opposite to the Rosstrappe, which is a huge granite rock, rising to a precipitous height. Between these two heights is a yawning chasm, clothed with fine trees and shrubs, at the bottom of which flows the river Bode, winding its way along the weirdly beautiful Bodenthal.

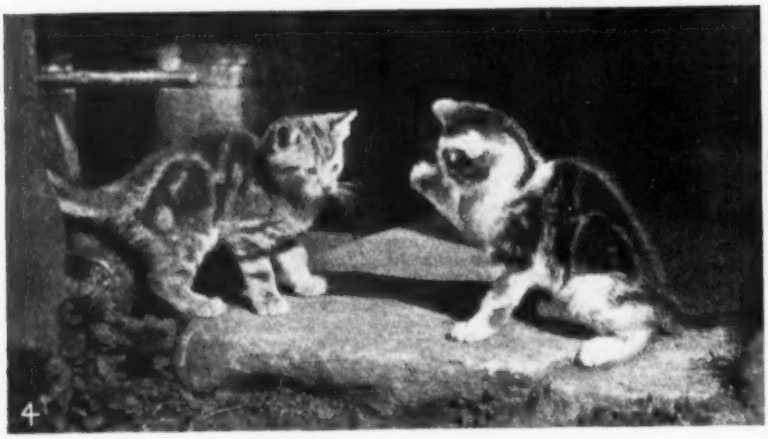
Wild legends are connected with this region of the Harz. The Hexentanzplatz is the place where the witches were said to hold their Walpurgis night revels. An hour's halt was made on this plateau. Post-cards, decorated with witches riding on broomsticks, were despatched to friends, and slices of black bread and glasses of milk were eaten and drunk.

Enquiries were made at the inn for the Girtonian who was to have met our two friends here, and a message was sent to the party at the Brocken.

At half-past twelve o'clock the two left the Hexentanzplatz and took the steep, winding paths down into the valley. In an hour they reached the foaming river Bode, and began the beautiful walk through the Bodenthal. The valley is wild and dark, perpendicular walls of trap-rock rise hundreds of feet in height, and on the loftier ridges on the other side the

(*Continued on page* 238.)

OUR AMATEUR PHOTOGRAPHIC COMPETITION.—Selected Specimens.



1. A Cambridgeshire Drainage Mill. *H. Ellwood.*—2. "Shall I?" *Walter Rossiter.*—3. In Dunbar Harbour. *William S. Andrew, M.A.*
4. Playmates. *J. W. Eadie.*—5. In Douglas Bay. *Albert E. Malburn.*—6. Gossip. *William S. Andrew, M.A.*
7. At Scarboro'. *John Howell.*—8. Ships on the Stour (Kent). *W. Scott Jones.*—9. On the River Wharfe. *Jno. W. Atkinson.*
10. Harbour, Bridlington. *Leonard Stevenson.*—11. "Carina" and "Vendetta." *J. M. Cassels.*

OUR AMATEUR PHOTOGRAPHIC COMPETITION.—Selected Specimens.

1. Fountain. *Edwin Day.*—2. His Welcome Home. *J. W. Eadie.*—3. Glen Helen, Isle of Man. *J. Howard Harris, F.R.His.Soc.*
4. Chaffinch's Nest. *J. M. Cassels.*—5. A Martello Tower, Channel Islands. *J. Howard Harris, F.R.His.Soc.*—6. On the Fal, Cornwall. *John Foy Morshead.*
7. Watching the Boats. *J. Kearney, jun.*—8. The Way to Find Work. *J. Kearney, jun.*—9. Young Athlete. *Joseph Oliver.*—10. Sopley. *H. Ellwood.*

huge masses of granite intermingle with, and sometimes overtop, the forests.

They passed the Bodekessel, a grotesque basin of granite rocks through which the stream rushed wildly; then they entered the beautiful woodland path beside the river Bode, which led on to Treseburg. The walk was very beautiful, but the tourists were ravenously hungry. On and on the path went, and the Optimist inquired anxiously of each party of pedestrians they met, how far they were from an inn. But no inn appeared until Treseburg was reached.

It was half-past four when they spied the pretty bridge crossing the river and leading to the Weisser Hirsch, an inn of considerable importance. They hastened thither and sat outside under the acacia trees and dined. Deliciously cold, amber beer was served in pretty crystal globes. The Optimist said it tasted like nectar, and she wanted to carry one of the globes to England in memory of a meal fit for the gods. When they paid the bill they found that the price was also fit for the gods. Two and a half marks (*2s. 6d.*) was enough to feed two reasonable Englishwomen for a whole day was the Optimist's comment as they paid this sum each for the one meal.

To spend the night at the Weisser Hirsch was out of the question, but they were too tired to make plans, so they made their way into a deep, dreamy pine wood and lay on the springy withered pine needles, with their heads cushioned on their packs, and slept for two hours. Then the Optimist studied the guide-book, and found a modest and moderate hotel mentioned, and the two started off to find it. It was modest, but satisfactory, for the price for a bed was only one mark each; so they deposited their packs and engaged a bedroom. Then they strolled through the pretty village, which is beautifully situated at the confluence of the Bode and the Lupebode. At nine o'clock they returned to the inn.

The Optimist insisted that after dining so magnificently they could afford no supper, but she could not resist a glass of milk which only cost five pfennigs (one halfpenny). The Typical Englishwoman drank two glasses of milk and ate a slice of black bread and butter. She bestowed a fragment of crust upon the Optimist, who ate it cheerfully, although she said it was an extravagant luxury. She went to bed and wished for morning as fervently as did the Duke of Wellington on the eve of Waterloo, and she arose very early in order to satisfy her appetite with the breakfast of coffee, bread and eggs.

At eight o'clock a primitive wagon, called an omnibus, started for Rübeland. The fare was one mark, and the two tourists decided they could afford the three hours' ride. They shouldered their packs and took the box seats and started.

At the bridge stood the Girtonian, frantically waving her umbrella to stop the omnibus. She climbed up and announced she too was on her way to Rübeland. Her experiences were related, and the reasons why they had not met before were explained. She laughed immoderately at the fourth class railway fares and general economies of the others. She had stayed at the expensive Weisser Hirsch, as she had plenty of money, so they called her the capitalist.

It was a fresh and bracing drive. At Rübeland the packs and umbrellas were taken into the best hotel, and the party were advised to visit the caves and have dinner before going up the Brocken.

The caves consist of wonderful stalactite caverns with a number of fossil animal remains. The Girtonian said they were unique in Europe, and it was a positive duty to see them.

The party proceeded to the caves; but when it became clear that the entrance fee was one mark, the Optimist and the Typical Englishwoman refused to go in. The Optimist remarked it was a choice between caves and a dinner. The Girtonian laughed so much that the cave-keepers and the omnibus men crowded round to see what was the matter. Presently the Girtonian entered the caves alone, explaining to the gate-keeper that the other ladies had no money. This information amazed the onlookers, and they watched the proceedings of the strangers with interest.

The Typical Englishwoman went to the railway station to enquire the fares to Schierke, from where the ascent was to be made, and the Optimist went to look for a place where a cheap dinner could be procured. She found a shabby inn and a lean waiter, and she ascertained that swine cutlets and accompaniments could be obtained for 75 pfennigs (*9d.*), so she ordered them; then she fetched the packs of her friends from the elegant hotel and waited for the others.

The Girtonian declared the caves to be wonderful, and the Optimist remarked that the anticipation of seeing them would be something to live for in case she ever came to Rübeland again. The Typical Englishwoman reported that a seat in a car to Schierke was as cheap as the railway fare; so they decided to go by car.

It was two o'clock when the party started along the rough mountain road. The Optimist sat on the seat by the driver, and was amazed to find that he went to sleep the instant they started. She watched over him, guided the horses out of the way of the hay waggons, and declared to the others inside that she was saving their lives.

Schierke is the highest village of the Harz. It is a scattered collection of rude weather-beaten houses placed among wildly fantastic rocks. Goethe ascended the Brocken from Schierke twice before writing his *Faust*. The tourists stayed here to drink coffee at the hotel, and then began the Brocken ascent. Up and up the steep rocky paths, across heathery moors, and through paths with tangled shrubs on either side they went. Above and around them were herds of cows coming down for the evening milking; the tinkling of the bells reminded one of the Swiss mountains.

It was evening when the summit of the Brocken was reached. A clear cloudless sky, with golden tinges in the west, promised a glorious sunset. Our tourists rushed to the hotel first, to enquire after the Samaritan and the students. They found post-cards, letters and telegrams awaiting them, but no Samaritan. She had gone on with the students and awaited them in Goslar.

The chronic trouble in the Harz is hunger, and the tourists provided themselves with bread and cheese before they went outside to explore the Brocken. It was a clear evening, and they climbed the tower and made out some distant landmarks. The sunset came on gradually, and was very beautiful. Then the Girtonian found rare anemones and gentians, and the party visited the grotesque blocks of granite, which are called Witches' Wash-basin, Devil's Pulpit, and Witches' Altar. This is the spot where the witches met on the eve of May-day, the scene of the witches' revels in *Faust*.

About thirty people were spending the night up the Brocken. The Girtonian had an elegant room, with a superior wash-basin, and a window that faced east and caught the sunrise. The other two had a shabby room facing west, and small pie dishes to wash in, but their accommodation suited their purses. At five o'clock in the morning all the tourists were out to watch the sun rise, and at six everybody was suffering from a sharp attack of hunger, but the coffee and the rolls were good. The Girtonian says the Optimist and the Typical Englishwoman ate ten rolls each.

At 6.30 our party were ready to start. The Girtonian went towards Harzburg, and a Dutch boy joined her; she meant to meet the Samaritan. The other two made their way to St. Andreasberg. It was a glorious scramble down the Brocken in the early morning. The packs were no inconvenience, and the Optimist declared that she had a light unearthly feeling without her pack, which was uncanny. They met parties of German men who were going up. The men always greeted them politely, and stood and looked after them laughing.

It is not customary in Germany for tourist women to carry packs on their backs, nor to hop, skip and jump down the mountain paths as did the Optimist and the Typical Englishwoman. The Optimist got into a bog and spoiled the appearance of her serge skirt, but a halt was made at a hut to drink milk, and she washed her skirt in a pail of water, and raced along the road in the wind afterwards to dry it.

At St. Andreasberg, at 12 o'clock, the two travellers counted their money, and found they had just enough to get fourth-class tickets back to Erfurt. Another day could not be afforded, and the weather stifled all regrets, for directly they were seated in the big railway carriage with market women and showmen going to the Jena fair, it began to rain, and rained hard for three weeks.

The Harz journey cost about *5s.* a day on an average. The Optimist says she is going again some day, for the Harz is by no means exhausted, and the caves of Rübeland are still unexplored.

FORM, COLOUR, AND PAPER WORK AT THE BRITISH MUSEUM.

BY MISS J. M. DAVIES,
Head Mistress Tennyson Road Board School, Battersea, S.W.

THE British Museum is one of the steadiest friends of the London teacher, and that department of it known as the Reading Room, the favourite portion. Often on a Saturday morning in the winter months may be seen there the budding B.A., the full-blown M.A., or the L.L.A. of the future, taking down from the surrounding shelves huge armfuls of folios just suited to their needs, or else standing at the desks to fill up forms for other books less accessible. Who does not know the perennial comfort of that great, quiet, circular room which nothing disturbs but that truly British cough so familiar to a reader, that if it failed to make itself heard he would scarcely feel at home, the Museum cough proper being only met with here.

But *excuses*, good reader, this paper was not begun with the intention of describing the Reading Room, but rather to tell of something which may attract for an hour or two those who are wending their way thither to the Print Room instead.

This department has very recently acquired a collection of paper work which may be technically useful to some members of our profession, especially to those who are teaching advanced Kindergarten, or who may be on the look-out for a fresh hobby for themselves. Botanists also may gain a hint. The collection, whilst quite up to date or even beyond date, is yet quite out of date, and to solve this enigma nothing will be so satisfactory as to make a visit. Arrived at the Print Room the visitor's name must be duly recorded, and then application can be made for *Mrs. Delany's Paper Mosaics*. The obliging attendant will furnish the uninitiated with a copy of the rules, which requests, for one thing, the removal of gloves before a book is handled, and while you are digesting and acting upon this sensible requirement, he will be drawing from its allotted place one of the ten volumes in which are to be found, unbound, the beautiful paper flowers the making of which was the solace of the evening of a refined and intellectual life.

When Fanny Burney introduces us to her old friend, Mrs. Delany, who had been the means of securing to Fanny her position of lady-in-waiting to Queen Charlotte, she was over eighty years of age, and had for some years been at work with her flowers. In very early life Mrs. Delany had been married, at the wish of her parents but against her own, to a country squire of Cornwall, whose name was Pendarves. He was of the kind that the distant counties at the end of the seventeenth and at the beginning of the eighteenth century were not wanting in, and, withal, he was old enough to be the father of his wife. Fortunately, the ill-assorted union was soon dissolved by the death of the squire, and then the lady was free to follow her fine tastes. All this we gather from her Life and Letters, and we also learnt hat she finally became the wife of Dean Delany of Down. In her Irish home may still be seen the ceilings she ornamented in relief, which give a good idea of her original skill in decoration and of the deftness of her fingers. After a very happy married life of thirty years, Mrs. Delany was again a widow, and though she had lost nothing of her ability for work, she could not feel any pleasure in those occupations which had been much admired and encouraged by the Dean. And yet she could not be idle. Amusing herself one day with cutting out in coloured paper a *hortus siccus*, she was struck with its nearness to nature and put it aside to be shown to her like-minded friend, the Duchess of Portland, when next she should call. That lady, noting the skill it evinced, urged Mrs. Delany to copy other flowers. The advice was taken, but soon it was found that paper of correct colouring was not obtainable, whereupon the aged lady set to work and invented what she wanted. Living in rooms granted to her by George III., and being the intimate friend of both King and Queen, she was visited by the royal pair, who frequently watched the progress of the work and, considerately, had a special set of instruments made purposely to supersede the scissors. In the first year four flowers were completed, more in the second, and, later on, nearly a hundred, but the grand total intended was not quite reached, as failing sight came on.

Just as you open the cover of the first volume out drops a sheet of paper, all brown with more than a century's wear, which gives an account of the circumstances under which the mosaics were made, and on another time-tinted sheet is an extract from Mason's "Elegy," very appropriately describing her friendship with the Duchess of Portland.

And then come the flowers themselves, quite true to nature and copied from the best specimens the leading florists of that day could supply, Vietch of Chelsea being one of the contributors. The patience, the neatness—for no sign of extraneous gum is to be seen—as well as the skill shown in their minutiæ is truly wonderful. No point of colour is missed, even though several pieces of paper are sometimes required for the tiniest leaf or stalk. Sepals and petals, stamens and anthers, stigmas and styles are all so individually complete that the resultant flowers cannot fail in approaching perfection. At the foot of each page is the name of the place where the flower was cut out, frequently Bulstrode, the home of the Duchess of Portland, and also, at the opposite corner, Mrs. Delany's initials in monogram form, cut out in red paper till you reach the later work, and then, to indicate the failure of eyesight, the letters are in white paper.

It is scarcely possible to do justice to the whole collection at one sitting, and probably most people will not try more than half, and if they have a somewhat keen relish for old things, or have taken a particular interest in the lives of the brilliant ladies of the last century, now almost the last but one, they will, perhaps, go away with a feeling of satisfaction all round at what they have seen, and they may, if they happen soon, by chance, to be in the neighbourhood of Hampton Court Palace, or near the National Portrait Gallery, drop in to renew their acquaintance with those portraits of the artiste taken about the time when she was most busy with these delightful mosaics.

But for teachers, one thinks, there are also some helpful suggestions to take away for future use in school, or, at least, to read between the lines of paragraphs 4(*b*) and (*c*) of Appendix X. of *The Revised Instructions for Inspectors* for the present year. These paragraphs, it will be remembered, read thus :—(*b*) 'Colour may be studied in the following ways. When care is taken to provide a variety of tasteful shades of coloured paper, it is possible to combine the drawing, cutting-out, and mounting of a number of good designs, many of which may be in respect both of pattern and arrangement of colour the original work of the children themselves . . . .

'The use of templates makes it possible to stamp on the mind certain beautiful curves at an earlier age than children can draw them freehand . . . .'

'This kind of exercise has been fully developed by some of the officers of the London School Board. The advantages of it are that it promotes accuracy and good taste in colour and design, and also a sense of harmony and proportion. The *defect* of it is that the manipulation is somewhat monotonous, and it does not lead to much increase of knowledge of varied objects.'

(*c*) 'Children can express their impression of a flower, as, for instance, a bluebell and its leaves, much more easily by the brush only than by the pencil.'

After examining Mrs. Delany's flowers it is easy to believe that impressions of flowers can also be expressed in coloured paper, which may form an occupation in Kindergarten lessons to be used in illustration of lessons in Plant Life, which now forms a part of the new class subject—Object Lessons—and in the manipulation of paper for this purpose the defect mentioned in paragraph (*d*) is absent, there being no lack of variety of colour, whilst, on the other hand, there is a great increase of knowledge of varied objects, with the natural result of good taste in colour and form, and a quickened sense of harmony and proportion.

If children are encouraged to spend their home leisure in copying simple, favourite flowers, a new quiet interest is created which tells favourably on their home life.

Mrs. Delany lived long before Hand and Eye Training had been given a place in the education of the young, at least of the masses. No hint of compulsory education had come to

her, and Froebel was a name unknown. All the same, we can make good use of what was only intended for a private pleasure, and add another to the many obligations we all lie under to people who, long before we and our modern notions were born, were unconsciously preparing for us during their nearly-forgotten, quiet lives.

THE NATIONAL HOME-READING UNION.

THE session for 1897–8 of this excellent organisation has just begun, and, co-incidentally, a third cycle of four years has also just commenced. A four years' course is a well-arranged and well-connected syllabus of reading, and those who persistently follow it will feel at its close that they have received advantages something akin to University supervision. Young teachers would do well to band together in a circle and keep together, if not for four years at least for one. Their nominal fee, paid to the head-quarters, Surrey House, Victoria Embankment, W.C., will secure to them the right to a monthly magazine which contains capital introductions to the books of the course, besides much other valuable information. The subjects for the current year in the General Course include Economic and Social Science, History, Biography, Science, Literature, Old Greek Life, Travel. In the Special Courses section, French, German, Music and Shakespeare are also taken, to which, this year, have been added Browning, Botany, and some works on the colonies of Australia and Canada. People choose for themselves which course they take, and when an aspirant to further knowledge cannot find friends enough willing to form a circle he can go on with the reading alone. He is equally eligible to partake in all the benefits of the Union, and can, if he choose, join in the common holiday which is annually planned for all the members.

Systematic reading on the part of young teachers fresh from college is often found to be a very great pleasure, to say nothing of the profit. The break from student habits is less marked, and congenial friendships are either new-formed or maintained. One cannot help thinking that if all ex-students would become members of the Union a certain *camaraderie* would be set up at once in the profession that would, or could, have very pleasing issues. It might become a kind of freemasonry and be a useful introduction when Greek happens to meet Greek, not known each to other by personal features.

Head teachers of schools who wish to form circles out of their upper standards will do well to begin with the year (Oct.). They will find the Young People's Section again admirably planned, and they will note that eight of the books can be purchased at a penny each. It is always an advantage when a few of the books are cheap enough for the children to be able to purchase one or two, to have and to hold as their 'very own.' The London Board is still willing to allow the prescribed books to their schools, and will, doubtless, continue willing, for, small as the initial expense is, it is quite recouped at the end of the year by the books being absorbed into the school library.

We hear a good deal just now of the benefits likely to accrue from international correspondence of schoolboys and girls, and all must wish it well. But who can say how beneficial would be the outcome of a common course of reading all through the British Empire amongst the elder children of its schools and during the two or three years after their leaving school. Happily the N.H.R.U. is extending its work into several of the colonies, and therefore it is possible to hope that the movement in this direction, now small as a man's hand, may some day be co-extensive with the empire.

At present, till we know people very well, the one topic of conversation is the weather, because it is the only one of which there is common knowledge; but when the Union's efforts spread far and wide this time-honoured subject, perhaps to the grief of its clerk, may cease to be the staple of daily talk. In the meantime all who are interested in the movement can obtain full information as to membership, lists, reading courses, magazines, formation of circles, etc., from the Secretary, Surrey House.

MODERN EDUCATIONAL REFORMERS.

XXVII.—DR. SOPHIE BRYANT.

Headmistress North London Collegiate School for Girls.

IT is always matter for sincere congratulation when gifted men or women devote their talents to the great question of the education of the people. In England it is not the fashion for this to be done, except on a small scale, by an

MRS. SOPHIE BRYANT, D.Sc.

enthusiastic and clear-sighted few who have sufficient *nous* to see and sufficient faith to believe that the solution of this problem of the proper bringing up of the young lies at the root of most, if not all, the mighty social problems of our time.

The woman who, after a successful *début* as a novelist, turns her back on this most expeditious road to wealth and fame, and resolves to devote her time and her talents to the furtherance of education, must certainly be credited with a large portion of the true reforming spirit. This and more can be said of Mrs. Sophie Bryant, whose manifold services to English education call for recognition and appreciation at the hands of all who profess and call themselves educationists and lovers of their kind.

From her youth up Mrs. Bryant has lived in an atmosphere eminently conducive to zeal in matters scholastic. Educated by her father, the Rev. Dr. Willock, sometime Fellow of Trinity College, Dublin, and always keenly interested in the education of the people, she learnt from him and from her family to appraise education at its proper value, and more important still, to abolish sex in education, for it was never thought a bar to participation in the mathematical studies of her brothers that she was a girl; and the same applies to philosophy, in which most important of subjects to teachers, as well as in mathematics, Miss Willock excelled; moreover, the example of the father, who was keenly alive to the vital necessity for the proper education of the masses, and who did his enthusiastic best to meet this need in his north of Ireland parish, incited the gifted daughter to put her knowledge of mental science to practical application to the 'work of a good world-building' kind, such as may certainly be found in and about the schools.

The following quotation from a statement made by Dr. Bryant in the life of her fellow worker, Miss Buss, will give a clear insight into the early education of Mrs. Bryant, and also will show how Miss Buss and Mrs. Bryant became acquainted: 'It had never been suggested to me in my life that I had not an equal birthright to knowledge with my brother.

Hence it happened most naturally that I was an early candidate for the Senior Local Examinations, out of which came my acquaintance with Miss Emily Davis, and afterwards with Miss Buss. I remember seeing her among her girls in the intervals of the examination; and she, as I afterwards learned, was interested in the girl whose chief subject was Mathematics.'

How the 'girl whose chief subject was Mathematics' afterwards (in 1879) took 2nd place in Honours at the London Matriculation Examination, how she graduated B.A. in 1881, taking the 1st place in the 1st class in the Moral Science Honours List, and a 2nd class in Mathematical Honours, and how, three years later, she took her D.Sc. at the same University, being the first woman to achieve that distinction—we need not pause to narrate. That her thesis was on 'Organised Character,' accords well with the work to which she is lending herself to-day, both practically in school and theoretically in her books, the two latest of which, viz., 'Studies in Character' and 'The Teaching of Morality,' bear eloquent testimony to Mrs. Bryant's devotion to what should be the chief aim of a teacher, to wit, the formation of character.

Miss Buss had sufficient insight to recognise the worth of 'the girl whose chief subject was Mathematics,' and engaged her at first for a portion of her time only, but very soon permanently, at the North London Collegiate School. 'Her brilliant young fellow worker,' as Miss Buss herself delighted to term her, more than fulfilled her early promise, and upon the decease of Miss Buss it was felt that her successor could but be found in Mrs. Bryant, a conclusion only rendered more firm by the posthumous testimony, as it were, of Miss Buss herself, who left the following note amongst her papers, where it was found after her death: 'I know Mrs. Bryant well, and think her the most competent woman in the whole range of my acquaintance to take up my work after me. She is bright, accomplished, energetic, and earnest. She is amiable and loving, and has, above all, *vital force*. She has indeed 'a healthy mind in a healthy body.' Pages of writing could not express more strongly my conviction that she is the one woman who would and could carry on the school in the same spirit as it is carried on now. Her fellow workers would be loyal to her, and she would be considerate about them.'

The reference to a healthy body reminds us that Mrs. Bryant is a devout believer in athletics. She is a cyclist, and has, accompanied by two guides only, surmounted the lofty summit of the Matterhorn. Small wonder then is it that she takes keen interest in the sports of her girls, encouraging them both by her example and by her presence to attain to a high degree of physical development.

Another fact bears witness to the solid common sense of Dr. Bryant, and testifies against any belief that she is a mere bookworm. 'Certainly,' she says, 'all girls should be brought up to the use of the needle; and the use of the needle is not acquired by a course or two of special lessons—it needs either long training or a special natural gift. In this respect Needlework differs from Cookery, in which a shorter course—taken at a later time—is sufficient. It has been well suggested that a year's training in womanly work might be a suitable ending to the regular school course, especially for those who do not proceed to places of higher intellectual study.' Readers of Spencer's 'Education' will at once remember how ardently he advocates such a training in the 'Life and Duties of a Mother,' and certain it is that one of the advances to be made in natura' educational practice in the remote future will be in the direction suggested by Mrs. Bryant.

But it is not as the successful principal of a school which, with its branches, numbers upwards of a thousand pupils, and occupies the proved position of premier amongst Girls' Schools, that teachers will feel most drawn towards Dr. Bryant.

To teachers of all grades she appeals as the apostle of character formation. This most difficult and least visible part of the teacher's work is evidently her perpetual study, concerning which she never tires of speaking or of writing. At the College of Preceptors, at teachers meetings—we recall with pleasure an instance of this in connection with the Finsbury and City Association—in magazine articles and in her books, her cry is with Thring, 'Character and not cram'—a worthy rallying cry for a reformer.

Of her books, a list of which is given herewith, we value most 'Educational Ends,' and the two recently issued volumes referred to above. Here is a quotation from 'Studies in Character,' which we are assured practical teachers will read with interest: 'The educator is largely, perhaps mainly concerned with helping the child to grow his own ideas, habits and modes of feeling. But he is also occupied in causing the formation of regular groups of ideas in every special subject of instruction. The English teacher, and the English parent, however, have very uncertain notions as to the usefulness of making conduct a special subject of instruction in this sense. Education, as practised, does not set itself as definitely as it might to the work of causing the formation of a group of practical ideas controlling the whole of conduct. At this point it is deficient in moral education.' The truth of this contention is indisputable; and again, it may safely be prophesied that in this direction teaching will ere long set a more definite course. What makes Mrs. Bryant's suggestion as to the what and how of moral training most valuable is, that it founds itself in the sound accepted principles of moral science. Her doctrine is no mere string of rules for which no reason beyond empiricism can be given, but a calm reasoned exposition, rationally set out and logically convincing. This, of course, cannot be proved by quotation here, but a perusal of Mrs. Bryant's works will bring this important conviction home to the reader's mind, and will amply justify our high opinion of this branch of our Reformer's work. It must not, however, be thought that this grounding of moral education upon moral science puts out of court suggestions as to practice. Quite the contrary is indeed the case, and here is a quotation in proof thereof: 'Preaching, as it used to be called, has gone out of fashion, and nothing has been placed in its stead. We all believe firmly, however, in the efficiency of good example, and example is one of the most effective ways of placing moral ideals before the mind, and getting them to be rooted in the mind. For those little gifted with inspiration it is the only effective way, because the idea is here presented clearly, vividly, and, as a whole, while other methods suggest it less definitely, less vividly, and require more constructive effort on the part of the recipient to ensure success. The example lives before the mind from day to day, and gets itself learned, as we learn to know the furniture of the room in which we live. The importance, therefore, of surrounding youth with good examples cannot easily be over-estimated . . . . . The influence of imaginary examples, as set forth in literature, is much less duly estimated. Parents are much too careless as to the literature in which their child's ethical imagination is nourished, and so wrong examples mingle in the mind with right, no due perspective being observed among the crowd.'

To make these 'imaginary examples' potent for good and powerless for evil in the development of character, Mrs. Bryant proceeds to make two practical suggestions:—(1) Care should be taken to surround the young with literature of the **best ethical tendencies**, literature in which goodness exhibits itself in gracious personal forms, and makes its appeal direct to the imagination in a glow of noble feeling. To read of true heroes and heroines is to know them, and to know them is to love them. The presence of such glowing ideals of action in the mind makes for righteousness.

(2) The reading of literature for ethical purposes should be to some extent—not entirely—carried on **'under the guidance of persons whose sense of right and wrong in conduct and character is penetrating and just.'** In addition, Mrs. Bryant draws attention to the efficacy of epigrammatic mottoes which express ideals of conduct in 'forcible though abstract terms.' 'On some minds these general prescriptions of conduct and character work more effectively than do the concrete illustrations.' She instances the eloquent Biblical appeal to thoroughness: 'Whatsoever thy hand findeth to do, do it with all thy might;' which, in her own case, was a continual clarion call to sustained effort.

Again she quotes the motto: **'Not to be ministered unto, but to minister,'** than which no more expressive incitation to unselfishness is conceivable. To this is added Carlyle's tribute to sincerity, another kernel saying, obedience to which would most powerfully react on character. **'The true merit of originality is not novelty; it is sincerity.'**

The foregoing extracts are culled from 'Studies in Character,' and will serve in some small measure to show how mind-extending this book will prove to the earnest teacher. Equally capable of good is 'The Teaching of Morality,' from which we proceed to extract a few suggestive sayings and a few practical recommendations. Here is a lucid declaration of the meaning of morality: 'Morality, in the first place, is the steady recognition by a man of himself as **an individual who ought to live according to some system of conduct which binds him equally to all his fellows.** This steady recognition of the moral law, or duty, as binding, passes over into the constantly repeated preference for dutiful courses which is the good or well and firmly directed will . . . . . So far we have found in morality the familiar ideas of **conscience** and **virtuous disposition,** both finding expression in a system of life to be lived. Knowledge of this system, and judgment in applying it—these make **moral wisdom** the third element in morality.' Thus for **conscience, virtuous disposition,** and **moral wisdom** is morality compounded, and to the culture of each of these elements the teacher must look. Then follow some wise words as to the duty of the teacher as moral trainer. 'The educator labours to assist in bringing about the full fruition of morality in the child. It is not enough that he should understand morality. **He must understand how morality gets itself accomplished without his interference, and he must, with much searchings of hearts, consider how his interference can be of use.** His first step, therefore, will be to inquire how and under what conditions the good man most easily and certainly becomes himself, and likewise under what conditions he is likely to fail.

It will then remain for him to see **what part he can take in securing the presence of those conditions, for it would make for success and the absence of all that tend to cause failure. Stimulus, sympathy, and example he would add as of course.'** How this may be done is duly set out by the authoress, whom we cannot follow in this particular. We must, perforce, content ourselves with the statement that in the chapter on the 'Principles of Teaching' (as applied to the teaching of morality), Mrs. Bryant, the moralist, makes it quite clear that she is at the same time the accomplished practical teacher, thoroughly well versed in the theory and practice of her craft. After reading this chapter, we are not surprised to hear that the Head Mistress of the North London Collegiate School for Girls does not permit the duties of superintendence, organisation, and management—onerous though these must be—to prevent her from teaching her special subjects to the more advanced students—a practice which has always seemed most necessary to us, since the teacher should never degenerate into a mere overlooker who can never find time to teach.

We must not put down our pen without quoting from 'Educational Ends,' which upon inquiry at Messrs. Longmans we find to be entirely out of print; but which we hope to see reprinted for the benefit of those who desire a well-reasoned and well-expressed statement of what the end and aim of education should be. We quote from Mrs. Bryant's concluding chapter: 'At the outset of our inquiry it seemed convenient, as being in accordance with ordinary ideas, to divide the object of inquiry into two parts. Conceiving the end of the education to be of assistance to those educated, in **their proper work of making the most and the best of themselves**, we saw that this conception of his work implies the idea of a standard character, the development of which is the best development. We have found them (the good person and the wise person) to be the persons whose minds are set on the supreme objects respectively of universal conduct and universal knowledge, and who are realising their objects. **The good man lives in duty by moral law and for the moral ideal of humanity. The wise man lives in knowledge by logical law and for the intellectual ideal of humanity or truth.** . . . Goodness implies and requires wisdom. Wisdom also implies and requires goodness. Both are implied generally in the conception of a life that not only develops but has got conscious ideas of its own development and purposes corresponding.'

We are painfully conscious how poor a taste of our Reformer's quality we have given our readers, still we must write 'Finis' to this pleasant task of bearing testimony to the labours of a doughty champion of true education, who, in common with Locke, and indeed with all the best amongst thinkers on education, places **virtue** before wisdom, learning, or good manners. That Mrs. Bryant is recognised as an authority upon education is apparent, from the fact that she, together with Mrs. Sidgwick and Lady Frederick Cavendish, were invited to join the Commission of Inquiry into Secondary Education, in the deliberations of which she took by no means the part of a mere spectator. That she may flourish exceedingly in her attempts to spread abroad the true educational doctrine, viz., that it is better to develop character than to cram in knowledge, is our fervent wish, for Matthew Arnold was guilty of understatement rather than of shooting beyond the mark when he said that 'Conduct is three parts of life.' All praise, then, to the teacher who not only puts virtue first in theory, but who strives with might and main to put this belief into hourly practice by lucidly expounding what morality is, and by laying down the methods whereby the good and the wise person may be developed out of the child who possesses but the seeds of goodness and wisdom, to bring which to fruition requires tender, constant care, and a double portion of intelligence.

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Our Monthly Retrospect

EDUCATION IN ENGLAND.

BY T. B. ELLERY, F.R.G.S.,

1895-6 *President of the National Union of Teachers, Chairman Teachers' Benevolent Fund.*

The Coming Orphan Election. The 26th Orphanage Election and the 34th Home Allowance Election will be held on December 11th. There are seven candidates for three vacancies in the Boys' Home (the Council will subsequently elect one boy under Rule 30), but in the case of the four girl candidates there will be no contest. The Home Allowances are each of the value of £13 per annum. Seven orphans will be elected by the contributors and three by the Council, and at the time of writing there are nineteen candidates! All these cases comply with the rules—all, therefore, are deserving; yet only 50 per cent. can be successful. Would that our funds were in such a flourishing condition that every deserving candidate could receive a Home Allowance or be received into one of our Homes! Readers of the PRACTICAL TEACHER have rendered valuable assistance in the past. May I once more make an earnest appeal for further help? I have had a seat on the Council for many years, I know how carefully every penny is spent, I know what time is given to the work and the enthusiasm with which my colleagues discharge the duties entrusted to them, and therefore I can honestly make this appeal. Subscribers of 5s. are entitled to one vote, of 10s. to two votes, and so on.

The Duke and Duchess of York are Patron and Patroness respectively; Sir William Hart Dyke, M.P., is President, and there are 52 Vice-Patrons and 60 Vice-Presidents. I shall be happy to send full particulars of the Fund, its past and present work, to any reader who takes an interest in this great and deserving charity.

The Benevolent Fund 'Jubilee' Annuity Election. Those who follow the doings of 'Conference' will perhaps remember that at the annual meeting of the Benevolent Fund a suggestion was thrown out that an additional number of annuities should be granted in order to mark the Diamond Jubilee year. Careful consideration has been given to the proposal, with the result that applications were invited from teachers who had been members of the fund for at least three years. Eleven teachers submitted their claims, and the Central Committee thereupon decided to elect them all without calling upon contributors to go through the form of voting.

It was a bold step to take, but the action of the Committee has been very generally approved. It means *an extra £400 a year*, but I am confident that my fellow teachers, who have been so generous in the past, will again find the means, and thus make the Diamond Jubilee year memorable in every teachers' home in the country.

It was my duty and my privilege to declare the eleven candidates duly elected—a little function probably unique in the history of the funds. May the fortunate eleven live long and enjoy good health!

Science and Art Teachers' Conference. That the Executive of the N.U.T. is mindful of the interests of every section within its ranks is evident from the fact that, having arranged and successfully carried out Conferences of Rural Teachers and Voluntary School Teachers, it is now turning its attention to a meeting, on similar lines, of representatives of Science and Art Teachers. This gathering will be held, I believe, in London on the 7th January, 1898, and will consist of two sessions—morning from 10 to 1, and afternoon 2.30 to 4.30. Many matters of considerable interest and importance will be brought forward, including the new regulations of the Science and Art Department.

It is to be hoped that all who are competent to assist will place their services at the disposal of the Executive, the members of which body are most anxious to bring about necessary reforms.

The Certificate Class Lists. The new arrangement by which the students are placed in two lists—one with respect to their professional and the other their educational qualifications—has caused widespread dissatisfaction. Many of those who took a high place in the Scholarship list, and also a 1st class at the end of their first year's training, find themselves in the 1st class in Part I. of the Certificate Examination, but in the 2nd class, and some even in the 3rd class, in Part II. Principals and tutors of the Training Colleges complain bitterly of the 'results,' and do not hesitate to say they are unjust in very many cases. In some instances, students who have had a wonderfully good record throughout their college course have *failed altogether* in this final examination. It is clear there is reason for a most serious inquiry in order that fair play may be secured to these young people. The Department should have given full notice of the proposed change, which most certainly ought not to have been brought into force in the case of students already in the Training Colleges. The best way out of the difficulty is to rearrange the recently published lists on the lines of former years. There will be time enough then to consider plans for the future.

The Coming London School Board Election. 'The poor you have always with you.' The same may be said of the Religious 'difficulty.' The Apostles' Creed was to be the election cry of the Moderates at the ensuing election, but a serious split has occurred which, in all probability, will lead, if it has not already led, to the formation of two Moderate camps.

With such a division it should be easy for those who have really the interests of true education at heart to secure a great victory. Efforts are being made in several quarters to bring about an agreement between the two hostile sections of the Moderate party, but so far these efforts have not been altogether successful. Says *The Church Family Newspaper*—'We gave our support to the use of the Apostles' Creed in Board Schools under the impression that it might prove acceptable to all bodies of Christians. The sequel has shown that this agreement is impossible. . . . . Even Churchmen themselves are divided on the matter, and among the opponents are to be found representatives of both the Evangelical and the High Church party. We regret that unanimity on this method of dealing with the religious difficulty is evidently unattainable, but there is no other way than to accept the result at once and see if there is any other course on which Churchmen, at least, can agree.'

The Guardian urges Churchmen to throw all their strength into obtaining facilities for denominational teaching in Board Schools and join battle on this question alone. With Mr. Diggle the Apostles' Creed in the schools of the L.S.B. is impossible; with many Churchmen Mr. Diggle himself is impossible!

How will it all end?

Representation of Teachers on the Governing Bodies of Associations. As a Churchman I feel bound to protest against the action of the clergy, and those associated with them, in refusing to admit teachers to the Governing Bodies of the Federations created under the Act of this year.

Here and there, it is true, one or two have been selected, but in the great majority of cases the teachers have been wholly ignored. And yet these are the men who have stood by the Church Schools at all costs! They have suffered in pocket by their allegiance, and they have struggled on under disheartening conditions of staff and apparatus. Is this the sort of treatment one might have expected from the leaders of the Voluntary School movement? I confess that I was in no sense prepared for it. Many of us had confidently looked forward to the election of teacher experts on these Governing Bodies, especially after the many kind, flattering words of the bishops! What is the position? The proportion of teachers to other members elected is as follows: Wesleyan, 1 to 4½; British, etc., 1 to 7; Roman Catholic, 1 to 9; Church of England, 1 to 36 or 37! The experience of Carlisle, where two teachers were nominated and *both rejected*, has been the experience of the vast majority of districts throughout the country. It is a burning shame!

Two Union Tenure Cases. The case of Mr. Whittaker, at Richmond, continues to occupy the close attention of the officers and members of the N.U.T. executive. As I observed in a former note the Richmond Town Council recently agreed to apply the voluntary rate to the maintenance of Holy Trinity Schools. This was done more from a desire to keep a School Board out of the place than from any opposition to Mr. Whittaker. Steps have been taken to prevent the Council collecting this voluntary rate along with the other rates, and I hope and believe that the fair-minded portion of the inhabitants of the borough will take good care that their money is paid to Mr. Whittaker's account.

In the meantime, the Union's School continues to flourish, the number on the books is increasing, and the percentage of attendance is still very satisfactory. The Aycliffe case is also attracting considerable attention. Very shortly the new school will be completed, and Mr. Thompson will be able to continue his work under more favourable conditions.

I hope to be in the neighbourhood shortly, and shall then be able to give further particulars.

Inspection and Examination. Several complaints have reached me as to the action of certain Inspectors during their 'Visits of Inspection.' I am informed that in some cases cards of sums have been given to the children to work, composition exercises set, and the worked papers carried away; that in fact the two systems of inspection and examination have been combined! This surely was never intended by those responsible for the new order of things; and I have not the least doubt in my mind that irregular practices will be stopped as soon as the attention of the Education Department is drawn to them. On the other hand, one hears from other sources how satisfactorily 'Inspection' is being carried out, how well the system is working, and how great is the improvement on the old annual 'field day.'

The truth is, I imagine, that different men have different methods, and that some little time must elapse before all concerned—teachers and inspectors alike—have settled down comfortably to rational methods.

Presentation to Mr. C. H. Heller, B.A. After four or five years of excellent work on the Executive of the N.U.T., Mr. Cyrus Heller decided not to seek re-election at Easter last. This decision was received with very great regret by his colleagues, and it is an open secret that considerable pressure was brought to bear upon him to induce him to remain at Russell Square. But several considerations compelled him to seek retirement, among them family reasons. As Vice-Chairman of the Finance Committee he rendered most valuable service, nor did he confine his efforts to one department alone. The Executive felt, therefore, that some sort of recognition of his interest in the good cause should be made. This took the form of an overmantel, which was presented to him by the President of the Union at the last meeting of the Executive. The President's remarks, Mr. Macnamara's tribute, and Mr. Heller's reply were admirable in every way, and worthy the occasion. All who know the late Vice-Chairman of the Finance Committee will join me in wishing him many years of happiness and prosperity. Personally, as I said at the time of the presentation, I feel I have lost a sincere friend, a colleague whom to know is to love. But there is one comfort. His enthusiasm for the Union will frequently compel him to turn his steps towards Russell Square: he will, therefore, not be lost to us entirely.

The Church Congress and Education. The National Union of Teachers was well represented at the recent Church Congress in the person of Mr. E. Gray, M.P., and Mr. Waddington, the Vice-President. Both delivered excellent telling speeches, and both had a cordial reception.

Perhaps the best and most useful paper read was that presented by the Bishop of Hereford. Speaking of school organisation he said, it ought to be taken for granted that secondary and primary education should be co-ordinated and brought, sooner or later, under one common administrative system. He imagined there was general agreement that this involved the establishment of a strong central educational authority and an intelligent local authority, sympathising with educational progress, and containing a preponderance of members experienced in educational matters.

Dr. Percival on the Religious 'Difficulty.' In the course of the same paper the Bishop of Hereford touched upon the religious question in elementary schools. He suggested that in denominational schools the general religious instruction should be Biblical, but there should also be given at stated times additional religious instruction, based on the formularies of the denomination; and it should be the duty of the head teacher to make reasonable provision for similar additional religious instruction to children of other denominations if the parents desired it. In Board Schools the general religious instruction should be Biblical, but it should be the duty of the head teacher to make reasonable provision for additional religious instruction to any considerable number of children whose parents desired it. In conclusion the Bishop urged upon the parochial clergy the duty of working day by day in their parish schools.

Mr. Ernest Gray, M.P., and the Archdeacon of Exeter. One of the features of the session in which National Education was discussed was Mr. Gray's eloquent repudiation of the views put forward by the Archdeacon of Exeter. Mr. Gray said he disagreed with almost every sentiment expressed by the Archdeacon. He did not desire to see the Church of England a close corporation dealing only with religious education in the Voluntary Schools. He wanted the Church to be true to her own character, and embrace the whole country in her educational efforts, not to constitute the diocese as the area of organisation, leading to a counter organisation by those opposed to the Church, and to the perpetuation of conflict and antagonism. Plain speaking, was it not? How necessary it was, however, many teachers know only too well.

Payment of Rates by Voluntary Schools. Are Voluntary Schools exempt from the payment of rates?

That was the question which exercised the minds of the Islington Vestry on October 15th. It was stated that the rate for the half-year was made on April 1st, but that the Voluntary Schools Act did not come into force until April 8. It was further stated that the Attorney-General had expressed the opinion that the schools are liable for the payment of the whole amount of the rate as soon as levied. The vestry, therefore, authorised proceedings against the managers of schools for the recovery of the whole half-year's rate.

The Cheltenham Conference, 1898. It is, no doubt, a far cry to the Cheltenham Conference of 1898, but I may, perhaps, be allowed to say that the various local committees are in full swing, and that already several important arrangements have been made. There will be, it is understood, a dinner and a ball in the Assembly Rooms, a very large gathering of Masonic brethren, college re-unions, etc., etc. Probably, too, the Principal of the Training College will offer hospitality similar to that extended to old 'Chelts' in 1888. I am further informed that the Excursion Committee will have great treats in store for Conference representatives. Mr. F. F. Wheeler, member of the Executive, is the General Secretary, as he was ten years ago, so that everyone may rest assured complete satisfaction will be given on all points. I need not say here that Mr. Wheeler is an able man and a splendid worker.

Every member of the Union knows that. The arrangements for the Conference could not be in more capable hands, and that, too, perhaps, might go without saying. May health and strength be given to him that he may acquit himself as he acquitted himself in 1888. Better work than he did then could not be done by any man.

M.B.T.A. Annual Meeting. Our friends of the Metropolitan Board Teachers' Association held their 25th annual meeting at the Memorial Hall, Farringdon Street, on Oct. 16th. Six thousand five hundred and seventy-five teachers in the service of the Board, or about eighty per cent. of those eligible, are now members of the Association. Mr. T. F. Bowers, B.A., the President, gave his address, in the course of which he said that there was an evident desire to capture the schools, not in the interests of true religion or of education, or of the children, or of the parents, or of the moral good of the metropolis, but in the interests of narrow sacerdotalism, which would sterilise the whole work of the schools. He was confident, however, that whatever might be the result as to the schools the successful party would not capture the teachers. The present system had satisfied the parents, the managers, and the Board's own inspectors. Any attempt, therefore, to upset it must end in disaster. The religious lesson was dear to every teacher, for it was felt that his or her influence on the child, both spiritually and morally, was greater than any words could express.

May I take this opportunity of congratulating Mr. Marshal Jackman on his successful year of office, Mr. Bowers on his election to the presidential chair, and all the members on the present position of their powerful organisation ?

The Need for Systematic Commercial Education. On Thursday evening, Oct. 14th, the members of the City of London Tradesmen's Club, assembled at the Albion Hotel, Ludgate Circus (Mr. John Lobb in the chair), had the pleasure of listening to a paper by Mr. T. A. Organ, L.C.C., on 'The Need for Systematic Commercial Education.' Mr. Organ is chairman of the special committee appointed by the London County Council to deal with this subject, and is, therefore—altogether apart from his practical experience in school—peculiarly qualified for the writing of such a paper, in the course of which he contended that one of the chief causes of the threatened displacement of our trade was the almost entire absence from our schools of any system of commercial education, a matter which was very far from being overlooked by foreign rivals. The paper made an excellent impression, and Mr. Organ was warmly thanked for his services.

EDUCATION IN SCOTLAND.

BY JAS. PATERSON,

Vice-President of the Educational Institute of Scotland.

Sir Henry Craik on Education. Sir Henry Craik, Secretary of the Scotch Education Department, has been addressing meetings at Glasgow and at Broughty Ferry. In opening a new wing of Glasgow High School, of which he is a former pupil, Sir Henry delivered an address in which he argued in favour of general education as opposed to specialisation. The time might come when special training with small capabilities would serve them but little, and when they would need that innate intelligence, that ready adaptability to circumstances, that wide sympathy, that abiding sense of responsibility, which made great citizens, and through them a great nation. At Broughty Ferry Sir Henry, referring to technical education, said that what he had often missed among those who spoke on the technical side was a definite scheme and a wish to make it practical. They could not train in the schools one man for one handicraft and another for another; but surely an art institution in an art school might tell them something of how the preliminary training of the pupils should proceed. He expressed the belief that thoroughly good work would in time be done by the Burgh and County Committees.

Generous offer to Dunfermline. Mr. Andrew Carnegie has opened communications with the Dunfermline School Board on the question of building a handsome technical school in that town, and has indicated his willingness to hand over 7,000*l.* for the erection of the building. It is some years since a technical school was proposed for Dunfermline. A scheme then formulated met with strenuous opposition, however, in consequence of the expense; and, although there was a majority of the Board in its favour, it had to be abandoned. Mr. Ross, who has just received from the E.I.S. the degree of Honorary Fellow, and who was so closely identified with the unsuccessful scheme referred to, has been appointed one of two Dunfermline representatives of Mr. Carnegie in connection with his generous offer.

Deadlock at St. Martin's Board School, Perthshire. Matters educational in the parish of St. Martin's, Perthshire, are in a very curious position. In June last the Board, by a majority of three to two, resolved to dismiss the teacher, Mr. Paterson. Since then, one of the unfriendly members has resigned his place on the Board. The Chairman, who with another member wishes to reinstate Mr. Paterson, some time ago called a meeting, but the two opposing members absented themselves, and in consequence there was not a quorum. While this action prevents the reinstatement of the teacher, it at the same time prevents the appointment of a successor, and Mr. Paterson meantime continues with the sanction of the chairman to occupy his position. It may be stated that Mr. Paterson's reports have invariably been of a highly satisfactory character, and that 90 per cent of the parents of the children attending the school presented a petition praying the Board to retain his services. The next move on the part of the Board is awaited with interest.

Scottish Society for the Prevention of Cruelty to Animals. The directors of the Scottish Society for the Prevention of Cruelty to Animals (Secretary, Mr. Langwill, C.A., 88, George Street, Edinburgh) have for some years past offered prizes for essays on kindness to animals, written by school children. The directors consider the movement a great success, as the productions of the pupils gave promise of much usefulness, and were of considerable literary merit; and they are anxious to have the subject brought prominently before School Boards and teachers.

Presentation to a Teacher. Mr. Henry Cowie, M.A., who for the past nine years has been the head master of Logie Coldstone Public School, having been appointed to the head mastership of the New Deer Public School, it was resolved to present him with some token in appreciation of his qualifications and success as a teacher, as well as his services in connection with the public affairs of the district. Accordingly, a committee of ladies set to work with the result that Mr. and Mrs. Cowie have been presented with a number of valuable and useful articles, including a marble clock and a gold bracelet for Mrs. Cowie.

Jubilee of Dr. McLaren, Larbert. Dr. McLaren, Minister of Larbert and Dunipace, and an ex-president of the Educational Institute of Scotland, has just celebrated his jubilee as minister of the united parishes; and, to mark their high appreciation of the worthy doctor's character and work, the parishioners have with great liberality founded a memorial church in honour of the occasion. Dr. McLaren was one of the ablest and most popular of the occupants of the E.I.S. presidential chair, and the whole teaching profession will rejoice to learn of this handsome recognition of his long and faithful services as a clergyman and an educationist. Very general regret will be felt, however, that Dr. McLaren has been for some time past in feeble health, and that he has in consequence considered it his duty to resign his position as member and chairman of the Larbert School Board—a position which he has, with the cordial approval of the parishioners, held almost uninterruptedly since the passing of the Education Act.

Scottish Assistant Teachers' Association. The Federation Council of the Scottish Assistant Teachers' Association met in Edinburgh on the day of the E.I.S. annual meeting.

There was a full attendance of representatives. A comparative statement of salaries paid by some of the leading Boards in Scotland was submitted by the secretary, Mr. Fenton, and it was decided to group these according to the size of the Boards, and issue the statement in pamphlet form along with an ideal scheme. The training of teachers having been introduced, and an explanation given as to the composition of the committee which watched over the interests of Queen's students at Aberdeen, it was decided to urge other university centres to action on lines similar to those existing in Aberdeen, with the proviso that on such committees there should be representatives from the ranks of such organised professional unions as the E.I.S. or the S.A.T.A. The next meeting is to be held at Stirling at the time of the New Year Congress. The association is in a flourishing condition, and is doing much to improve the position of its members, both professionally and financially.

Edinburgh Branch S.A.T.A. A meeting of the Edinburgh branch of the S.A.T.A. was lately held. Mr. R. G. Dickson, M.A., presiding. Mr. Thomas Inglis, F.E.I.S., Springburn Public School, Glasgow, read a paper on the departmental system, in which he examined the causes that rendered a change in the present school arrangements necessary. He gave statistics to prove that the number of schools in proportion to the average attendance was steadily decreasing. In the present system he thought there was a want of method and unity, and he asked whether it was not possible, in the interests of education, to devise a better method. He argued that some devolution of authority was necessary, and he proposed as a remedy the division of schools into departments. In the discussion which followed it was pointed out that in secondary schools the departmental system is adopted in some form or other.

Scottish Episcopal Teachers' Association. The first annual general meeting of the Scottish Episcopal Teachers' Association has just been held. The President, Principal Leslie, of the Episcopal Training College, sketched the work of the Association during the year, and congratulated it on its success. In connection with the special grant to Voluntary Schools and the action taken thereon by the E.I.S., the following motion was adopted: "That this Association protests against a resolution which has been adopted by the E.I.S. to the effect that Government aid grants to Voluntary Schools shall be such as they cannot be taken advantage of to increase the number of these schools." Regret was freely expressed that such a resolution should come from a body composed of teachers of all denominations.

Edinburgh Branch E.I.S. The opening meeting of the Edinburgh branch of the E.I.S. was held the other Saturday, and took the form of an afternoon visit to the Outlook Tower, University Hall, now in course of arrangement as a geographical, historical, and economic museum of Edinburgh, Scotland, the Empire, Europe, and the world, which, it is hoped, will be available in a year or two as a link among students and teachers. More than two hundred members availed themselves of the invitation, and were conducted over the different storeys by Professor Geddes, assisted by Mr. Guyou and Mr. Home. When the party had finished their tour of inspection a very cordial vote of thanks was, on the motion of the President, Mr. S. M. Murray, given to Professor Geddes and his assistants.

Science Subjects in Day Schools. The determination of the Science and Art Department no longer to recognise the study of science in Day Schools has created much dissatisfaction among school managers and teachers. The Glasgow School Board have, notwithstanding, decided to carry on the day classes as formerly, and have given instructions that the attendance registers are to be kept as in previous years. The pupils are to be presented for examination at the S. and A. examinations as hitherto, but it is not clear from the circular on what grounds the Board expect them to be examined. It is rumoured that the Board's action has been dictated by a belief that some concession in the matter of payments will yet be made. Teachers who are continuing these subjects might, therefore, be well advised to follow the example of Glasgow and to register the attendances as formerly.

Ex-President Adams at Leith. Mr. John Adams, M.A., B.Sc., Ex-President of the E.I.S., opened the winter session of the Leith Assistant Teachers' Association, choosing as his subject 'En Attendant.' Mr. Adams, as usual, delivered a thoroughly practical and valuable address. In the course of his remarks he counselled class-teachers to make themselves indispensable to School Boards and the community. Let them magnify their office. It was not sufficient for a teacher to have great culture; he must be able to teach. They should know the best books of the profession, but it was of still greater importance that they should seek to make school-management books for themselves by studying 'cases.' He was struck, he said, by the *esprit-de-corps* which pervaded the medical profession. When young doctors met together they talked of their latest 'cases,' and sought to give each other the benefit of their knowledge. Teachers might with profit follow the example. There was nothing he liked better than 'shop' of that kind. In dealing with the law of supply and demand as affecting teachers' salaries, he said that many—especially lady-teachers—would rather accept a smaller salary than leave their native place. In the interests of education, in the interests of themselves, young teachers should take country places, as many who did take these places acquired thereby far greater knowledge and experience.

Professor Laurie on Secondary Education in Primary Schools. In his opening lecture for the present session, Professor Laurie dealt at some length with the question of providing secondary education in primary schools. While opposed to what he called 'professional secondary education' in primary schools in centres having fully-equipped secondary schools, the professor observed that there are in the former class of schools many children whose parents rightly wish for them secondary education in the sense of more advanced education, and that it is the duty of School Boards to provide this. Every Board School, the professor said, should as a matter of course have an ex-sixth standard, and a curriculum of 'industrial secondary education,' carrying pupils to 14 or 15 years of age, should be organised in a certain selected number of Central Board Schools. The subjects of instruction in these schools should be English, including history (much attention being paid to composition), physical, commercial, and industrial geography, practical arithmetic, including book-keeping, practical geometry, and drawing; some one science experimentally taught, French, as much English literature as it is possible to get the pupils to read, and manual instruction. In the case of girls, he would substitute for some of these subjects dressmaking, mending, and the various departments of domestic economy. The termination of this course should be marked by the Government Merit Certificate so altered as to meet it. If more instruction is wanted it should be sought for at Evening Continuation Schools.

Child Study in Edinburgh. The current session of the Edinburgh Branch of the British Child Study Association had an auspicious opening on Friday, 15th Oct. A large audience, representative of advanced educational thought and practice, assembled to listen to a lecture on 'The Dynamics of Ideas in Children,' by Mr. John Adams, M.A., B.Sc., Principal of Aberdeen F.C. Training College. Mr. Adams is well known, through his popular lectures and writings, as an able exponent of Herbartian thought, and his lecture on this occasion was well fitted to maintain and increase his reputation. His treatment of the Herbartian theory of ideas was extremely clear and suggestive, and his crisp and humorous style and happy illustrations added a charm which is not always found in a philosophical discourse. Through the courtesy and co-operation of many teachers in Edinburgh schools, this association has been enabled to conduct some practical experiments in Child Study, the results of which will occupy part of the winter session, and promise to be of great interest.

EDUCATION ABROAD.

BY E. E. FOURNIER D'ALBE, B.SC., A.R.C.S.

THE question of Federal subventions to education in Switzerland has again been discussed by the Federal Council. The member for Zurich asked the Home Secretary what steps had been taken to carry into effect the Curti resolution, which asked for a report on the question as to how far the cantons could expect to be aided by the central government. The question turns mainly about the point of law. Those who favour Federal subvention quote Article 27 of the Constitution, which enjoins that primary education must be sufficient throughout the country. This would imply central control, and therefore, where necessary, central subvention. Herr Ruffy, the Home Secretary, replied that the legal question had not yet been reported upon. It was evident, however, that the cantons by themselves were unequal to their scholastic burdens, and that if the educational standard of Switzerland was to be kept abreast of the times, it would be necessary to make a great effort. But the moment seemed inopportune. Other questions monopolised the attention, such as Government insurance, State railways, and the unification of civil law. The popular rejection of the provisions for a Federal bank and military centralisation was not encouraging. In consequence of this reply, the teachers have begun a popular agitation in favour of the proposed subvention as the only means of carrying it into effect.

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THE primary school system of Roumania dates, according to the *Revue Pédagogique*, from the year 1896, but education was made free and compulsory as far back as 1864, and included all children between seven and fourteen years. Unjustified absences are fined to the maximum extent of 5d. In the country schools there is, as a rule, only one teacher. In the towns the schools are divided into classes, each of which has its teacher, who follows his pupils into the higher classes from year to year.

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THE coming year will witness the apparent creation of a large number of French universities. This will be effected by the new Decree, according to which the present provincial 'faculties' shall not only be Universities, but be called by that name. Thus the old Napoleonic system of a single National University at the head of the numerous provincial Faculties is abandoned. The various municipalities are celebrating the auspicious occasion. New chairs have been created in Bordeaux, Poitiers, Clermont, Nancy, Lille, and Toulouse. Local colour and traditions are to be favoured again. Caen is to have a chair of Norman art and literature, Lille for the art and literature of the Picardie, and Aix of the Provence. Toulouse and Grenoble are paying special attention to Spanish and Italian literature. All this is very remarkable, and it is a sign of the times. The dead uniformity of the past is to give way to vigorous and many-coloured provincial developments. Instead of receiving its officially-approved inspiration from Paris, each province is to contribute its own best native work and spirit to the life of the nation. Whether the smaller Universities will be able to maintain themselves now remains to be seen. Paris University has an annual income of 600,000 francs, Lyons 130,000, but Besançon and Clermont barely 700. Perhaps something like local co-operation or federation will meet the difficulty.

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Since last year the spirit monopoly is gradually being introduced into Russia. The sale of spirit is to be reserved for the State, acting through its officials. Strange to say, it is chiefly the elementary school teachers who apply for this employment, and in many towns, but more especially in the country, a decided scarcity of teachers has set in, and many schools have had to be closed. This deplorable state of things is largely due to the miserable salaries paid to country teachers. They find that they are better paid for selling vodka.

The 'concentric' system of instruction is gaining ground in France. The idea of repeating in the higher standards the work lightly skimmed in the lower ones is old, but its practical realisation only became possible when M. Seignette issued his capital series of reading books published under the name of *L'Ecole Moderne*. M. Édouard Petit, in the *Journal des Instituteurs*, says: 'The concentric school is, indeed, the school which begins with the known and proceeds to the unknown, which utilises that which has been acquired for the acquisition of further knowledge. The circle is always growing. The master who has to give a lesson in history to boys of nine or ten years, chooses, let us say, a certain reign. He will deal with the same reign in instructing boys of eleven years, but will give further detail. He will have no additional trouble of preparation, and the pupil also gains. The continuity, the similarity, the remembrance of the same ideas will engrave them on his memory. It is an incessant revision, and we know how much the child depends upon repetition to assimilate what he has learnt.' The history or other subject taught in the lower stages is only presented in a series of pictures, so to speak, involving only the best known persons and things. These objects, once thoroughly grasped, form nuclei, round which the further details can crystallise in coming years. This system is the only efficient one in rural schools, where there is, as a rule, only one teacher.

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The *Deutsche Blätter* contain a highly interesting summary of the growth of the large cities in the 19th century. The most phenomenal development is exhibited by Brooklyn, with its 806,343 inhabitants, or 339 times the number it had in 1800. Chicago comes next with 245-fold increase; New York and Philadelphia, with 1½ million and a million respectively, have increased 25-fold, Baltimore ten times, Berlin, Buda Pest and Leipsig nine times, Munich eight times, Glasgow and Sheffield seven times, Leeds, Liverpool and Warsaw six times, London, Lyons, Paris, St. Petersburg and Prague four times, Copenhagen and Marseilles three times, and Amsterdam, Brussels, Birmingham, Manchester and Rome have doubled. The only large city with a decreasing population is Dublin, which has been reduced from 261,000 to 245,000. But this excludes the rising and prosperous suburbs.

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The Report of the Minister of Education of Ontario contains a special report on the moral standing of pupils and teachers in the public (elementary) schools, which exhibits a most painstaking interest in many questions which in other countries are left to the conscience and self-respect of the teacher. Among other things, the Inspectors are instructed to answer the questions: Do many of your teachers teach in a Sunday school? Do they follow the regulations regarding religious instruction? Are these exercises conducted reverently? Is the moral character of the teacher generally helpful to pupils? Are your teachers and trustees willing to allow clergymen to visit their schools and talk to their children? One of the opinions quoted is worth repeating: 'At present every teacher is under the tongue of good report. I know of only three who are not total abstainers from intoxicants. Unfortunately some of the male teachers are addicted to the pipe or cigar. Personal cleanliness requires abstinence from such filthy stuff.' Also 'teachers and trustees are much more willing to allow clergymen to visit schools than clergymen appear to be to visit. On 116 teachers only 78 calls were made in 1895, and of these one bright attractive young lady received 10 per cent.'

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The advantages of education, says Mr. John Plummer, are fully recognised by Australian colonists, and there is scarcely a township or village, however small, which has not its public school, especially in New South Wales, where every effort is made to reach the scattered population in the bush, the families of 'selectors' living at remote distances from the nearest townships being periodically visited by travelling teachers, who set home lessons for the children, and from time to time ascertain the progress made. The general aptitude of the scholars is remarkable, the dull stolid element being less conspicuous than in many other countries.

OUR CLASS ROOM AIDS

LESSON ON THE BUTTERCUP.

BY PROFESSOR J. R. GREEN, SC.D., F.R.S.

Examiner in Botany to the University of London;
Late Examiner in Botany in the University of Cambridge.

SEE SUPPLEMENT PRESENTED WITH THIS NUMBER.

Illustrations.

THE children should bring to school specimens of Buttercups, of which there are several species, differing only slightly from each other. They may be found in any meadow or by the roadside. To controvert their idea that all buttercups are yellow flowers it will be well for them to bring specimens also of the white-flowered, ivy-leaved Crowfoot, which may be found all the summer growing by the margin of ponds and rivers or in the water itself.

As the Buttercup is to be considered as a member of a family, the children should be encouraged also to bring for comparison specimens of (1) the bright, red-flowered Pheasant's Eye, a not uncommon weed in cornfields; (2) the white or purple garden Japanese Anemone; (3) wild Clematis, from the hedges, or small-flowered Clematis, from the garden, both of which will be in fruit; (4) the common red garden Pæony, which may be obtained with its shrivelled petals still surrounding the fruit.

Drawings with coloured chalks should be made by the teacher of the following members of the Buttercup family, distinct in their character, but not to be now found in flower: (1) Marsh Marigold, (2) Hellebore, (3) Columbine, (4) Larkspur, (5) Monkshood.

In the case of living specimens they should be dug up carefully, so as to show the root and stem as well as the flower. Young specimens should show clearly the buds, old specimens the fruit. Drawings are best made in outline, showing clearly the marked peculiarities of the plant.

Outline of Lesson.

I. WHAT IS A BUTTERCUP?—We may regard a Buttercup (1) as a plant possessing various parts, each with its own individuality; (2) as a living organism whose parts carry out the various processes of its life, an organism which reacts to its environment; (3) as being not an isolated individual, but a member of a family all the members of which agree in their main characteristics, but differ in minor details.

It gets its popular name from its cup-like shape, and the country custom of dabbing the yellow stamen dust against a child's chin to see whether it likes butter.

II. A BUTTERCUP IS A PLANT POSSESSING DIFFERING PARTS.—Let us examine a complete specimen of the Buttercup. We shall see (1) an underground portion, which we may in this case without hesitation call a *root*, though it would be a mistake to suppose that every portion of a plant found underground is a root. What then are the marks of a root? (1) It grows in a downward direction; (2) it attaches the plant to the earth (or other substance), from which it derives its nutriment; (3) it only bears such appendages as are like itself, that is, the root branches; it never bears anything like a leaf. The form of the Buttercup root will be seen to vary according to the species taken. In the Meadow Buttercup it is *fibrous*, presenting the appearance of a number of long threads or rootlets. In the Bulbous Buttercup it springs from a swollen portion, which is the base of the stem, and is *bulbous*. It is not a bulb like the onion. A bulb is an underground stem shortened into the form of a disc, which bears on its surface fleshy scales, which are modified leaves. It is by some botanists regarded as an underground bud of a scaly nature, which sends off roots, or rootlets, from below and a flowering stem upwards.

In duration the root of the Buttercup is *annual*, dying off every year, and differs from the roots of the Garden Anemone and Pæony, which are *perennial*, lasting several years.

On again examining our Buttercup we shall see that we have apparently several parts, which we call roughly the stem, leaves, flowers, and fruit. We may group all these together under the name of (2) *Shoot*. It is quite accurate to say that a Buttercup consists of two parts—root and shoot. How is the shoot to be distinguished from the root? It may be defined as an ascending axis together with the leaves borne by it. Such an underground axis, or stem, as that of the Primrose is found beneath the surface, and is likely to be taken for a root. It may readily be distinguished from a root by the fact that it has the power of bearing leaves. In the Buttercup the usual characteristics of a stem or ascending axis of the shoot are clearly seen. (1) It takes an upward direction into the air; (2) it bears leaves on its surface; (3) it has the capacity of branching, a capacity which, unlike (1) and (2), it has in common with the root.

Let us now look at the appendages borne on the axis. We have (1) the green *foliage leaves*, in which we may distinguish the following parts: Stalk, or *petiole*, and *blade*, or flattened expansion, which in the Bulbous Buttercup is very deeply divided. The blade is a branch system rather than a simple outgrowth. In the Bulbous Buttercup it consists of an axis and two branches, each of which is winged. The leaf blade thus consists of three segments. Each of these segments through branching becomes *tripartite*, possessing three partitions which reach nearly to the axis of the segment. On comparing the leaves of other members of the Buttercup family with the Bulbous Buttercup leaf-blade, we shall see much variety in form, good examples, on the one hand, being found in the much more deeply-divided leaves of the Pheasant's Eye and Water Crowfoot, and, on the other hand, in the *entire*, or undivided, leaves of the Marsh Marigold.

We will now examine the flower of the Bulbous Buttercup. It is a shoot consisting of more or less modified leaves arranged on an axis or thalamus. Dissecting it we shall see first an outer whorl, or series of protective leaves called *sepals*, forming the *calyx*, and within a whorl or series of brightly-coloured, attractive leaves called *petals*, forming the *corolla*. These two lower whorls of leaves form the *perianth* or enveloping organ of the two inner series of organs, which are more directly concerned in the reproduction of the plant. In the Marsh Marigold, Clematis, Anemone, and Monkshood there is only a single whorl instead of two, and these are regarded as sepals. Instead of speaking of calyx and corolla we used the term *perianth* to denote this series. The calyx leaves have become *petaloid* (petal like). The calyx leaves of the Buttercup and the other flowers chosen are quite distinct from each other, and can be separately pulled off the *receptacle* or *thalamus* (*i.e.*, the axis of the flower shoot). A calyx composed thus of free sepals is said to be *polysepalous*. In the Buttercup, Marsh Marigold, Anemone, Pheasant's Eye, and Hellebore it is also *regular* (*i.e.*, its sepals are of equal size and similar form and are arranged symmetrically. In Monkshood and Larkspur we have examples of an *irregular* calyx. In Monkshood the upper sepal is prolonged into a sort of hood. In Larkspur one sepal forms a spur. In the second and more deeply coloured flower-leaves of the Buttercup the petals are free from one another, equal in size and similar in form. The corolla is therefore *polypetalous* and *regular*. In the Columbine and Monkshood it is polypetalous, but *irregular*. The petals are spurred in the first case, and in the second the two petals situated under the helmet-shaped sepals are each shaped somewhat like an irregularly curved horn placed on a long, channelled stalk. The flower leaves of the second series are inserted on the *thalamus* alternately with the sepals. They are *hypogynous*. The two series of flower leaves already examined are protective to two series of leaves, which may be called *sporophylls*, since they bear the reproductive cells or spores from which new plants originate. The one nearer to the petals of these is called the *androecium*, and is composed of *stamens*, sporophylls bearing *microsporangia*, or cases containing *microspores*, or male spores, the pollen of the plant. These microsporangia—often called pollen-sacs—in the Buttercup family are several in number. The stamens are distinct from one another and are called *polyandrous*. Like the other two whorls examined, they are *hypogynous*—*i.e.*, inserted on the thalamus below the final whorl or *gynæcium*.

The series of sporophylls situated in the centre of the flower consists of several modified leaves or sporophylls called *carpels*. In the Buttercup family two parts may be distinguished in each carpel, the *ovary* containing one or more *ovules* or *macrosporangia*, in which

are the embryo-sacs or the female spores of the plant, and a terminal sticky part, the *stigma*, inserted in this family directly on the *ovary*. The carpels being free from one another, the gynæcium is called *apocarpous*. As they are also entirely free from the calyx leaves, the gynæcium is *superior*, standing at the apex of the thalamus. The calyx evidently, therefore, is the lowest whorl, and is termed *inferior*. On taking an advanced specimen of the Buttercup, we can clearly see a number of fruits, each of which is dry, superior, and one-celled, and contains one seed. Such a fruit is called an *achene*. Other examples of it may be seen on examing the Pheasant's Eye, the Anemone, and the Clematis. In the Clematis the carpels have stalked stigmas, and the stalks form long feathery tails, which give the plant its country name of Old Man's Beard. In the Columbine, Marsh Marigold, Hellebore, Larkspur, Monkshood, and Pæony, we have a form of fruit which is also superior and one-celled, but it opens or dehisces by the *ventral suture*, that is to say, the folded leaves or sporophylls open, showing the seeds. Such sporophylls are called *follicles*. In the Columbine, Larkspur, Hellebore, and Monkshood, we have from three to five follicles arranged in a whorled way on the thalamus. In the Pæony there are usually only two follicles.

III. A BUTTERCUP IS A LIVING ORGANISM RE-ENACTING TO ITS ENVIRONMENT.—Under this heading, we have to consider the functions of the different parts of the Buttercup and its allies.

(i.) *The Root.*—We may notice briefly (1) it is the organ of support to the shoot, and its branching tends to fix it firmly in the soil. (2) It is an organ of nutrition. Its delicate root-hairs absorb the films of water with the nutritive substances dissolved in it, which adhere after drainage to the particles of which the soil is composed. (3) It is irritable, for it is sensitive to gravity, light, and moisture. If a seedling buttercup is placed in a perforated vessel full of damp moss, and the vessel is hung up, the root will grow downwards through the action of gravity, and make its way through a perforation. If the surrounding air is moist, the roots will continue to grow downwards; but if dry, they will bend up towards the damp moss. If light reaches it from one side, it will, as it grows, curve away from that side.

(ii.) *The Stem.*—(1) The stem displays the leaves. (2) It assists in nutrition by conveying to the leaves in solution nutritive substances absorbed by the root, and it carries the materials formed in the leaves to the plant generally. (3) Like the root, it is sensitive to the action of gravity, but the inclination of the stem is in a directly opposite direction. It grows towards a lateral light instead of away from it, as the root does.

(iii.) *The Foliage Leaves.*—The leaves are the organs in which most of the crude materials of the food are converted into nutritious bodies, and made suitable to supply the plant's needs. They do this by means of the green colouring matter, or chlorophyll, which they contain. When they are exposed to light, they absorb a gas called carbon dioxide from the air, and from this, with the water and the mineral substances furnished by the root, the construction of food is carried out in the green cells.

(iv.) *The Flower.*—(1) The calyx is generally green. It serves to protect the undeveloped whorls inside the bud. When it is coloured, as in the Larkspur, Marsh Marigold, and Monkshood, it, like (2) the corolla, serves to attract insects, which are an important agency in pollinating the flower, *i.e.*, in transferring the microspores, or pollen, to the stigmas of the carpels. (3) The stamens are microsporangia bearing the microspores of the plant; (4) the ovules are macrosporangia bearing the macrospores of the plant. The pollen grains, when placed on the stigmas, send down pollen tubes, which find their way into the ovules by a little orifice called the micropyle. The fertilizing matter contained in these tubes results in the formation of a young plant, or embryo, within the ovule, which develops into a seed.

(v.) *The Fruit.*—The fruit contains the seed, of which it is till ripe the protection. Sometimes, as in the Clematis, it does not open, and is dispersed by the wind or animals. In other cases, as in the Columbine, it opens or dehisces, and the seeds are thus cast to some distance.

IV. A Buttercup is not an isolated individual, but a member of a family. The Buttercup family abounds in cool countries, and its members may be recognised by all its whorls being inserted on the thalamus and free, and its stamens being many in number. All the plants belonging to this order have a poisonous, acrid, and narcotic juice. The Clematis, Anemone, Batchelor's Buttons, Christmas Rose, Winter Aconite, Globe Flower, Monkshood, Larkspur, and Columbine are favourite garden flowers. Though very unlike in appearance, they all have the characteristics just mentioned. Monkshood is very poisonous, and is used in medicine. The juice of the Marsh Marigold boiled with alum furnishes a yellow dye.

CLASS LESSONS IN DOMESTIC ECONOMY.

BY ETHEL R. LUSH.

Author of 'Chats with Children on Domestic Economy,' Organising Mistress to the Ipswich School Board, Head Mistress of the Ipswich Higher Grade School.

Lesson XIV.

STANDARD IV.

CLASSIFICATION OF FOOD: CONDIMENTS, MINERAL SALTS AND WATER.

[*Apparatus required.*—Specimens of condiments and pictures of condiment-producing plants; fresh and burnt bones, and a piece of limestone; various mineral salts and a glass of water.]

HERE is an interesting array of little bottles; let us see what they contain.

First to hand comes *common salt*. Rarely is a meal spread without this adjunct, and more rarely still is a meal cooked without its use. But of this you will hear more presently.

Pepper, cayenne, mustard, mint, onions, capers, ginger, cinnamon, mace, nutmegs, vinegar and various essences are all to be found among our collection. It may have struck you that, though these substances can scarcely be called foods, they are always taken along with food, with the object of improving and adding to its flavour. To such food-adjuncts we give the name of *condiments*.

I am going now to divide this collection of condiments into four groups. The first includes common salt, though this is also a food, mustard, pepper, cayenne, capers, and mint; mushrooms and horseradish might also be added; these are *condiments proper*, and are eaten with savoury dishes. The second group comprises ginger, cinnamon, nutmegs, mace, and cloves, which may be classed as *spices;* these are used in making sweet dishes. *Flavouring agents*, the name by which we distinguish the third group, include essence of lemon, vanilla, and oil of bitter almonds. Among *acidulous substances*, the fourth group, we find vinegar and lemon juice.

You have been told that condiments are used with the object of improving, adding to, and bringing out the flavour of foods; they have also a stimulating effect upon the digestion, making the various organs quicker and more powerful in their action. But, like everything else, they must only be used in moderation, otherwise the digestive organs are impaired. Young children whose digestions are strong and healthy, and not in need of stimulation, should avoid all condiments but common salt.

It will be of interest to know whence we obtain the various substances now under consideration.

Mustard is prepared from the seeds of the mustard plant, which you have probably seen growing gaily in the fields, its yellow flowers shining in the sun. It grows especially well in the counties of York, Durham and Lincoln.

Table mustard is a mixture of pure mustard with wheat flour, as mustard alone is too pungent for general use. It should be prepared in this way: put a teaspoonful of mustard into a glass, add a little cold water and mix to a smooth paste, neither too thick nor too watery; warm water may be used instead of cold, but on no account must it be boiling.

Horseradish is similar to mustard in pungency of taste; it is the tap root of a cruciferous plant. To prepare it for table it must be well washed and finely scraped. It is eaten with beef, either in the scraped condition or made into sauce. Both these condiments, if used in moderation, aid digestion by increasing the flow of the gastric juice, but the excessive use of mustard injures the liver, and horseradish produces indigestion by adhering to the walls of the stomach and small intestine.

Pepper we obtain from the East and West Indies. Look at the map of the world and observe how these islands lie

with regard to England. Pepper is prepared from the berries or seeds of the pepper plant. If these are gathered before they are ripe and are dried in the sun they form black pepper. If they are left to ripen and the powder prepared from the berries with the outer covering removed, they form white pepper.

Cayenne pepper is the seed pod of a plant, ground up into a coarse powder of reddish colour. Like mustard it increases the flow of the digestive juices, but has at the same time an irritating action on the delicate lining of the stomach.

With *mint* you are very familiar; it grows in every kitchen garden, and its leaves are generally used for making the mint-sauce eaten with lamb.

Turning our attention to the group of spices, we pick up a specimen of *ginger*; notwithstanding the fact that we call it *root*-ginger, it is really the underground stem (rootstock) of a plant which grows in the East and West Indies. It is dried and ground into powder and used to flavour cakes, biscuits, etc. It is also preserved green in a sweet liquid, or crystallised and eaten as a sweetmeat at dessert.

Cinnamon is the inner bark of a small evergreen tree which grows in Ceylon. It is cut off in strips which curl up as they dry.

Nutmegs are the seeds of an East Indian tree—a kind of laurel. They form the kernel, and *mace* is the outside covering of the seed.

Cloves, so generally used in apple puddings and pies, are the dried flower-buds of an evergreen West Indian tree. You can easily trace a resemblance in the shape and formation of a clove to other flower-buds grown in this country.

Allspice (or pimento) is so called because it is said to contain the flavour of all the other spices. It is prepared from the berry of a West Indian plant.

Flavouring agents, such as vanilla and essence of lemon are used to flavour jellies, ices, blancmanges and various other sweets.

Among acidulous substances we find *vinegar* and *lemon juice*. Best vinegar is made from wine, ordinary vinegar from malt or beer. It is very useful as an addition to salads, also in pickling or preserving fish, and various vegetable substances. In small quantities it is useful, but taken in excess is injurious to the health.

Lemon juice is valuable for its refreshing properties and for its purifying action upon the blood. It is eaten with fish, veal, pancakes, and many other things.

Now we will turn our attention to another class of food-substances of which you have heard something before. Here is a bone, or rather what is left of it, for a large portion of it, has been burnt away in the fire. What remains is porous and brittle, I can crush it between my fingers into a fine greyish-white powder. We have heard in previous lessons of foods which form flesh, and of others which give heat and make fatty tissue. This third class, to which your attention is directed, now goes to build up the hard parts of the body, such as the bones, teeth, hair and nails; and looking at the ashy powder which comes from bone, you will find it easy to believe that these bone-making foods are *mineral* in character. Here is a piece of limestone; it is sufficiently like bone to show you that they both belong to the same natural kingdom, and as a matter of fact, *lime* is one of the mineral salts which enters most largely into the composition of the bones and teeth. Possibly you know that when a baby's bones are slow in strengthening, or its teeth slow in coming through the gums, one remedial step is to add lime-water to the baby's milk. We find, therefore, that one use of mineral foods is to build up the bones and other hard parts of the body. A second and very important use is to help in the formation of the blood and digestive juices; a third function is that of purifying the blood.

Were we to be deprived of mineral salts in our diet, the blood would rapidly become impoverished and impure; skin diseases would follow, and general deterioration of health would be the result.

Common salt, the most important of this class, is the only one that is taken alone; the others are found as constituents of various foods. It is obtained in large quantities from salt springs and sea water. Rock salt, which is given to cattle, is obtained from beds of salt which occur in some rock formations. Salt is obtained from brine springs by evaporation. A simple experiment will explain to you what this means. Before the lesson I mixed a glass of salt and water, part of which was poured into a shallow dish and placed quite close to the fire. The solution in the glass remains unchanged, as you may see, but the water in the saucer has disappeared—the heat of the fire has drawn it into the air in the form of vapour, and nothing is left in the saucer but a deposit of salt. It is by similar treatment on a large scale that salt is obtained from the springs of Nantwich and Droitwich. Common salt is found in every part of the body; it enters into the composition of all the tissues, the blood and the digestive juices; indeed, without its aid the latter could not be formed. These facts will prove to you the necessity for this mineral in our diet.

Other mineral salts are found in small quantities in many of our foods: thus, in water, milk, cheese, bread, and jellies we find *salts of lime* (calcium salts), which you will remember are necessary to build up bone and teeth.

Salts of potash (potassium salts) are contained in fresh vegetables and fruits, meat, milk, and bread; they are especially needed to purify the blood.

Iron salts, which give the red colouring to the blood, are found in lean meat and, in small quantities, in all our foods. A deficiency of these salts in the blood is indicated by a pale complexion and accompanied by general debility.

Salts of magnesia are contained in most of our foods; they assist in the purification of the blood.

There is but one more specimen left unnoticed on the table—a glass of *water*. Very briefly we will consider what part this plays as an article of food. Because, considered dietetically, it is neither animal, vegetable, nor, strictly speaking, mineral in nature, we do not place it in any one of these classes, but consider it separately. Good drinking water should be colourless, tasteless, and without odour. It should be free from suspended matter, and should contain no impurities in solution.

I showed you just now that salt can be dissolved in water and afterwards be recovered; sugar and many other substances may be treated in the same way. This property renders water very valuable in assisting the digestion of foods.

We find that more than two-thirds of the body by weight, and as much as four-fifths of the blood, is made up of water, and as large amounts of water are lost daily from the skin, lungs, and kidneys, it follows that water takes an important place in our diet.

How do we supply the water needed by the body? It is, of course, taken largely in the form of beverages—tea, coffee, cocoa, beer, wine, and spirits—as well as in the simple state, and in addition all solid foods contain greater or less proportion of water, green vegetables and fruits, as much as 90 per cent.

In conclusion, let us sum up the uses of water in the body: it keeps the blood and digestive juices in a fluid condition, thus enabling them to perform their functions; it softens food, thereby assisting its digestion; and it carries away, dissolved in it, many waste substances which must be separated from the body, as, for example, the perspiration which brings impurities from the blood on to the surface of the skin.

Summary.

Condiments include:

(*a*) Condiments proper—pepper, mustard, horse-radish, capers, &c.

(*b*) Spices—ginger, nutmeg, mace, cinnamon, &c.

(*c*) Flavouring agents—vanilla, essence of lemon, and oil of bitter almonds.

(*d*) Acidulous substances—vinegar, lemon-juice.

Mineral Salts.—Common salt, calcium salts, potassium salts, salts of iron, and magnesium salts.

Water—Uses: (1) To maintain the fluidity of the blood and digestive juices; (2) To carry away waste products from the body; (3) To enter into the composition of all the tissues of the body.

'COMPOSITION THEMES AND MORAL TRAINING.'

A SERIES OF LESSONS PREPARED ON A NEW PLAN FOR THE UPPER STANDARDS.

BY B. ELDERKIN,
Model School, Westminster College.

☞ **THE LESSONS FULLY MEET THE LATEST INSTRUCTIONS IN THE NEW CODE, 1896.**

Hints for successful use of these lessons.

a. The subject matter may be *read* over by the teacher or even by one of the scholars, or, better still, the teacher may previously read it and give the substance to the class in his own words. He may thus at discretion introduce other illustrations or omit some of those given.

b. The blackboard summary may be put before the class if the teacher is short of time, or, what is much better, a similar one may be made up while the class is being questioned on the matter of the lesson.

c. The whole of the essay should be put before the class at the first lesson, but it will often happen that there will be sufficient matter for two or more written exercises.

d. It is not intended that these lessons should be used exclusively, but that they should form a part of every month's Composition work.

e. Keep the best exercises, so that the Inspector may see the plan upon which they have been worked, as well as the topics written upon, or have a separate exercise book for Composition.

LESSON VIII.—ON THRIFT.

1. The life of Samuel Budgett, 'The Successful Merchant,' as he has been called, affords many valuable lessons in the subject of 'Thrift.'

2. Like many other men who have risen to eminence, he had few advantages to start with, his parents being quite poor people, and his education was so scanty that he very nearly lost a situation for which he applied because he could not successfully reckon up the cost of 86 lbs. of cheese at 9½d. per lb.

3. He showed very early in life a marked aptitude for 'making money,' and a tenacious 'grip' upon all the odd pence which came in his way. Few boys and girls have less money through their hands than young Budgett had, and yet it is to be feared there are not many who could give such a good account of themselves. His motto throughout life was 'Get all you can: save all you can: give all you can.' Not any one of these rules taken by itself would form a safe guide to a useful life, but taken together they form a simple code of thrift which it would be hard to beat. '*Getting*' without giving would lead to *covetousness*; '*getting*' without saving would mean *extravagance* and *want*: '*Saving*' alone without giving would make a *miser*, and '*giving*' without getting and saving would make a man a thief or bankrupt.

4. Young Budgett commenced saving with his first penny, which was well earned by carrying for three miles a horseshoe picked from the road, and selling it to a village blacksmith. On another occasion he earned a few pence by collecting some molasses which were accidentally spilt on the floor of his mother's shop and selling them at a greatly reduced price. Here we see not only his aptitude for earning pennies, but a great dislike to *waste* in any form, a habit which clung to him all through his business career.

5. On another occasion he earned a few pence by purchasing a basket of cucumbers which an old woman was carrying from door to door, and sold them for a gain of ninepence.

At another time, while he was out seeking a situation, he purchased a jay of a man in the street for a few pence, and then taking up the man's place he tried in vain for several hours to resell it at a profit. Finding no one would purchase his bird, he carried it from door to door until he obtained a shilling for it.

6. It may seem incredible to many young people who read this, but by the time he had reached the age of fourteen he had saved no less a sum than £30. At this age it was decided to apprentice him for seven years with an elder brother, who kept a grocery store at Kingswood, near Bristol, in the midst of a mining population. It would be easy to point out several ways in which £30 would have been great service to a young lad on leaving home, but while bidding his mother good-bye he placed the whole of it in her hands, and started out to his situation penniless. He had no fear for his own future, and he would not take away the money which he felt sure his mother was more likely to need than he. It is difficult to say which quality is more to be admired in Budgett's life up to this point—the self-denial and determination which had prevented him from frittering away in trivial and, perhaps, even harmful indulgences that thirty pounds, or the noble act which seemed like all the other and smaller denials rolled into one.

7. The next two or three years of Budgett's life passed over, and then another crisis was reached, for at that time his brother, for some reason which he afterwards regretted and repented of, came to the conclusion that Sam would never succeed in his business, and sent him home once more. The mettle of the lad was keenly tried, but good came of it, for he obtained a situation in Bristol which provided him with both a comfortable home and small sums of ready money for his own use. Not long afterwards he heard that his sisters, who had been trying to establish themselves in a small business, were badly off and not able to afford a small fire in their workroom. He went to a neighbouring coal pit and invested his savings, amounting to fifteen shillings, in coals for his sisters' benefit.

8. Budgett's brother was not long in finding out his mistake in getting rid of Samuel, and used his influence as a brother and the unfulfilled indenture of apprenticeship to such effect that Sam, notwithstanding he was exceedingly happy in his new situation, and did not wish to change, returned to his brother's shop and completed the seven years for which he had engaged to serve.

This apprenticeship ended, Samuel, who was now 21 years of age, was engaged by his brother as a helper and improver for three years at a rising salary of £40, £50, and £60 a year.

What would Budgett do with such large sums of money? Well, the boy who knew what to do with his pennies, and the young man who knew how to save fifteen shillings in a few weeks out of his pocket money, was not likely to be in difficulty, now that he had become a man, as to the disposal of £50 a year. The sequel will speak for itself. Soon after the three years had expired the elder brother got into financial difficulties through unsuccessful speculation, and he came to Sam to ask his advice. Sam's answer was, 'I have saved £100 in the last three years; if that will help you and save your business you are welcome to it.' So for the third time the whole of Budgett's savings were without hesitation given to help members of his family, when but for his care and frugality he could not have assisted them at all.

9. Samuel was now taken by his brother into partnership, and from that moment the business grew and prospered. Extension after extension of business was entered upon until the boy who sold the horseshoe for a penny became one of the richest, most respected, and most useful merchants whom this or any other country has ever seen.

One of his first acts on entering into partnership was to get rid of the custom of giving credit, by which he was able to save considerable sums known to business men as *bad debts*. He also seized every opportunity of new openings for extensions of trade—one such opening leading to the establishment of a large wholesale business in addition to the original retail one.

10. It was in accordance with his early habits also, to practise the utmost economy in matters of expenditure, and he deemed it of the greatest importance, as the number of their employees increased, to train them in the habits of thrift and economy. To this end every new lad taken on had to spend the first weeks or months in what might be termed the economy de-

partment, where his work was entirely confined to such duties as looking after old nails from the wooden boxes which were opened, pieces of string, rope, sacks, and all such odds and ends as would otherwise have been wasted. If the boy were faithful and successful in this kind of work, then promotion to some more responsible post followed, but economy was the law of the house from bottom to top.

11. Budgett, who had shown such self-denying generosity to members of his family, was not less unselfish with regard to his employees. He reduced to the lowest point their hours of work, and every week made gifts of money, besides their wages, to those whose weekly record of service and work had been completely satisfactory, and every year after stocktaking he apportioned out a share of his ever-increasing profits to his workpeople, according to their position or length of service in the firm. In these and other ways a strong bond of sympathy was created between employers and employed, which contributed much to the pleasant and successful working of a large business.

12. As an illustration of the deep interest he took in his workmen it may be useful to record that at one time he observed that one of them had gone about his duties for some time with a very depressed countenance. Mr. Budgett sent for him to his office, and learned that his anxiety was caused by a burden of debts which had been contracted through sickness in his family and other causes, and that his usual wages were not sufficient to enable him to pay the bills which had become much overdue. After thinking the matter over, Mr. Budgett obtained from him the names of all his creditors, with the amount owing to each. Then he made a personal visit to every one of them, and compounded with them for such an immediate payment as would clear off the account. The man was again sent for, and the receipted bills were all laid out before him. His gratitude may be more readily imagined than described, but the incident shows that prosperity had not in any way changed the generous character Mr. Budgett had at all times manifested.

But his generosity did not expend itself upon his own servants, for every deserving charity and work of beneficence in turn shared in his large-hearted liberality.

13. Mr. Budgett was a great admirer of punctuality, and it was a rule with him never to be late in keeping an appointment. He considered that he had no right to waste anyone's time by keeping them waiting for him, and he devised a plan by which without error or much trouble he could ascertain whether all his workpeople had attended punctually at the appointed time to take up their respective work for each day.

14. But no account of the life of this splendid business man would be complete which did not make it plain that his success was *honestly* and honourably achieved. He would have no share in any transaction, however it might promise to increase his income, if it involved the least suspicion of dishonesty. Travellers who called upon him with doubtful goods, and who pointed out how large profits could be made upon them, were indignantly refused further hearing, and it was the reputation that the firm obtained for fair dealing that helped in no small degree to continually extend their business.

A very amusing instance of Mr. Budgett's abhorrence of anything approaching deceit in trading occurred soon after he became a partner with his brother. In those days heavy duties were levied upon nearly every article of consumption. This had the effect of making them expensive, and led in many instances to adulterated articles being introduced at lower prices.

Pepper was one of these, and a compound known as pepper dust was frequently sold instead of the real article. One day Mr. Budgett saw a large barrel in the store with the tell-tale letters 'P.D.' stamped upon it. Budgett was troubled, and spoke of his uneasiness to his brother. The usual excuses were made that others did the same, and that the price showed that pure pepper was not being sold. But Mr. Budgett was not satisfied, and in the night he got up, rolled the cask out of doors, smashed it to pieces, and scattered the offending pepper dust to the winds of heaven. Having returned to bed he could not sleep because he had not brought in the pieces of broken cask, thus violating himself one of his most cherished rules. Another visit to the 'common' made good the omission, and then he returned to obtain the sleep of the 'just.'

15. In these days of keen competition boys and girls cannot begin too early the practice of thrift. Many a young fellow is hindered on the very threshold of his career by the want of those 'pounds' he has wasted in 'pence,' and often the opportunity of helping parents or friends is lost because there are no accumulated savings to fall back upon.

The means for saving are happily more numerous and convenient than in Budgett's day, and there can be no excuse for the neglect of this most pressing duty.

Blackboard Summary.

THRIFT.

The life of Samuel Budgett—

(*a*) How he saved his first penny.
(*b*) Instances of his shrewdness in bargaining.
(*c*) What he did with his £30.
(*d*) His apprenticeship, and how he helped his sisters from his pocket money.
(*e*) What he did with his £40–£60 a year.
(*f*) How he helped his brother.
(*g*) Business principles—punctuality, honesty, and care of odds and ends.
(*h*) His care of his workmen.
(*i*) The P.D., and what became of it.
(*j*) Why we ought to commence the practice of thrift early in life.

THE INSPECTOR'S NOTE-BOOK.

BY AN INSPECTOR OF SCHOOLS.

UNDER this system of intermittent inspection too much is made in certain districts of the visit of the Inspector. Say the school year ends April 30th. The Inspector pays a second visit about March 21st, at which he does a general clearing up of things not seen at his former visit, thus possibly conveying an impression, not intentionally may be, that the school will not receive any further official considerations until the opening of the impending year. Our friend, the head master, bids the parting guest God speed, and forthwith begins to array his school with a view to accomplishing much by the next expected visit from the Whitehall representatives somewhere about three or four months on into the succeeding year. And so he throws up his work set out for the twelfth month, since the Inspector has called previously. This is bad organisation. If the Instructions to Inspectors mean anything at all, the Inspector's visit is not intended to stop the machinery—to upset the steady systematic working of the school. Some teachers complain that there is too much to be done in the year, whilst others are able to fit up a yearly syllabus so elastic as to coincide with the second visit of the Government official.

* * * * * *

WHATEVER effect the new system may have upon the standard of education as far as producing results is concerned, there can be no question that a great work is being done in whipping up lethargic managers. In fact so much is this so, that I know of teachers who have got into trouble with the managers for suggesting improvements to the Inspector.

* * * * * *

IN fact in some places it is a common thing when the report speaks of additional staff or structural alterations, for the managers to at once come down upon the teacher, thinking him to be the one who has put the official up to the weakness. These worthy gentlemen have a very poor opinion of the agents of the Education Department, I am afraid. They forget that at least two-thirds of them are practical men, who by experience can often spot weaknesses directly they enter schools.

* * * * * *

BABIES crying with cold in rooms of a 40° temperature, teachers working themselves to death in atmospheres overcharged with CO_2, overcrowded class-rooms, and depleted staffs until the last three months, are gradually being wiped

act of existence. How often we hear that one master is expected to teach half-a-dozen standards, because the master in the adjacent village is dexterous enough to do that sort of juggling! And then they point you to the requirements, ignoring the word *minimum*.

* * * * * *

If every clergyman took a personal and lively interest in his own school, it seems to me we might at once dispense with the *Diocesan Annual*. I am not in favour of organised inspection taking its place. Surely in these days, when the Church is so keen on demonstrating to the world through its clergy how important is dogmatic religious instruction, it might be expected that the clergyman should be responsible for the consistent religious teaching of his own schools. But let me invite you to read the sensible and practical address given by the Bishop of Hereford at the late Church Congress. Surely it is a certain augury of educational sunshine when Bishops declare in favour of consulting the teachers!

* * * * * *

Many teachers and managers would save themselves a lot of unnecessary labour if they would but study their Codes. Especially is this the case with the Evening School organisation. All subjects to be taught must be submitted in the form indicated in Art. 2. Those who send up 'Reading' as a subject, have to be advised to look at the first page of the Code, and see that Reading alone is not there recognised. The same applies to handwriting and other subjects.

* * * * * *

Some teachers sitting for the Queen's Scholarship Examination in December do not quite know whether it is necessary to give formal notice of such to the Department. Of course by now all notices should be in, but my remarks will be helpful for future examinations. The fact is, that all managers should receive from the Department a form, $\frac{1}{10}$, upon which they should write the required particulars respecting Scholarship or Certificate candidates. They should then transmit this form to the H.M.I. of the district, who has certain reports to make upon it—Reading, Recitation, and Teaching. The transmission of this form to the District Inspector constitutes a legal application to sit at the particular examination. Those desirous of entering a training college must, of course, make their own arrangements with the respective colleges, and carry out the instructions given by those authorities with reference to formal application to the Education Department. If any candidate for the ensuing examination has not given a lesson before an Inspector, it would be advisable for the managers to communicate with the District Inspector on the matter.

Answers to Correspondents.

S.R.—It is doubtful whether you had better start in a fresh branch after so many years at primary work. If, however, you are a physically strong man and a good teacher, I feel confident that you would improve your position by taking an assistantship in a first-class higher grade school. You could supplement your salary by taking a class one night a week. In any case complete your degree without delay, and then, whether you are in your present school or in a higher grade school, you can reasonably expect preferment.

H.J. wants to know whether it would be advisable to miss the Scholarship Examination and proceed straight to the University. Most decidedly go in for Queen's Scholarship Examination and try to get to the day training college at either Oxford or Cambridge. Cambridge is preferable to Victoria. Could you take the Natural Science Tripos there? Take the certificate and the degree together. There is a great demand for trained teachers who have been within the pale of one of the older universities. Failing the above, try to get to the Yorkshire College, Leeds, or Owen's College, Manchester.

R.F.—It is not yet a regulation of the Education Department that the Drawing Certificate must be obtained before sitting for the Certificate Examination. Grace is allowed until 1900. See Art. 60 (small print) page 21, National Union Teacher's Code:—'No persons who have become otherwise qualified after 1900 will be recognised as certificated teachers unless or until they have passed through a course of instruction in Drawing satisfactory to the Department.' I do not understand the second part of your letter. You do not say whether you are sitting for the 1st or 2nd year Certificate examination. Write to me again, explaining more clearly what you ask under this head.

J.K.—The requirements for the Elementary Drawing Certificate (First Class) are a First Class in the elementary stage of—

1. Freehand Drawing (Subject 2*b*);
2. Model Drawing (Subject 3*a*); and
3. Shading from Casts (Subject 5*b*); and
4. A pass in the Elementary Stage of Science (Subject I).

Candidates who took parts of what was the 'D' before January 1st 1893, are allowed certain modifications of the above. See Science and Art Directory, Form $\frac{590}{A}$, or National Union Teacher Code, page 312.

There is now a 2nd class 'D' recognised for which the requirements are:—

1. A pass in the Elementary Stage of Science (Subject I).
2. A 2nd Class in the 2nd Grade Examination in, or the Elementary Stage of Model Drawing (Subject 3*a*); and
3. A 2nd Class in the 2nd Grade Examination in, or the Elementary Stage of Freehand Drawing (Subject 2*b*).

Parchment.—Ask your managers to write without delay to the Department, stating when you received notification that your Certificate would be sent in due course. Also name the school you were then at. Are you sure the Certificate was not forwarded to your last school?

R.H.O.—The method indicated would, I should say, be accepted in any examination. It does not, however, strike me as being an easy method, if I may be allowed to express an opinion.

LONDON SCHOOL BOARD SCHOLARSHIP EXAMINATION.

In December last was held the annual Examination for Scholarships which, by the liberality of certain City Companies and by the help of voluntary contributions, have been placed at the disposal of the School Board for London.

At the corresponding examinations to be held next month, as many as 83 scholarships, provided from funds similarly raised, will be competed for by scholars attending the public elementary schools of London.

As the scope and range of the forthcoming examinations, as set forth in the regulations under which they will be conducted, agree almost entirely with those of previous years, we are glad to place before our readers the papers of questions set last December, in the belief that they may be found useful for preliminary practice by the candidates. With a view to making them more helpful, we shall give answers to the questions in Arithmetic and Algebra.

It should be stated that the examination was divided into three parts. The Preliminary Examination included the ordinary general subjects, Arithmetic, English Grammar, and Composition, History, and Geography, with the addition of Drawing for the boys and Needlework for the girls. The Intermediate Examination was open only to those candidates who succeeded in securing two-thirds of the aggregate number of marks obtainable in the Preliminary. Such candidates might select any two, but not more, of the following subjects: Animal Physiology, Elementary Science, Mechanics, Chemistry, Algebra, Euclid, Domestic Economy (for Girls), Botany, French, Latin, Drawing (Girls only). The paper on Domestic Economy, with the addition of some questions on the Laws of Health, was used also to determine the award of prizes offered by the National Health Society.

The Final Examination consisted of *viva voce* questioning of the boys and girls who acquitted themselves best in the two written examinations. Like each of these it was held on two days; and the results of it combined with the marks previously obtained determined the final placing of the candidates in the order of merit.

QUESTIONS SET AT THE PRELIMINARY EXAMINATION.

Arithmetic.

Time allowed—3 *hours.*

(*All the working must be shown.*)

1. The sum of three numbers is 1,076,001; the first is 4761, the second is 367 less than the first; what is the third? (*Answer in words.*)

2. Reduce £94 7s. 6½d. to halfpence.

3. Multiply 9 mls. 4 fur. 39 pls. 2 ft. 8 in. by 39.

4. How many guineas, sovereigns, half-crowns, and shillings, of each an equal number, are there in £979?

5. Three men are walking together in step, and their strides measure respectively 27 in., 33 in., and 36 in.; how far must they walk before they are again in step?

6. Find (by Practice) the value of 6 cwt. 3 qrs. 12 lbs. at £7 13s. 6d. per cwt.

7. Simplify—

$$1\tfrac{1}{2} \text{ of } \frac{\frac{1}{3}+\frac{2}{3}+\frac{1}{2}}{2\frac{1}{2}-3\frac{1}{3}+4\frac{1}{4}} \times \frac{2\frac{1}{2}+1\frac{2}{3}}{3\frac{1}{7}\,\frac{1}{8}} \div \frac{4\frac{1}{2}}{3}.$$

8. Express 1·085 of £1 16s. 4½d. as the decimal of ⅔ of £14 11s.

9. Find the value of ·709 of 5 tons 3 cwt. 14 lbs.

10. If 5 men and 9 boys can do a piece of work in 17 days, in how many days could 9 men and 12 boys do it, the work of 2 men being equal to that of 3 boys?

11. Divide ·28413 by ·0231; and extract the square root of ·05368489.

12. Find, to the nearest penny, the Compound Interest of £473 for 3 years at 1½ per cent.

13. Holding sufficient 5½ per cent. stock to produce an income of £121, a man sells out at 112, and invests the proceeds in 3 per cents. at 96; what is the change of income?

14. I bought one pound of cinnamon for 7s. 6d., and sold one fourth of it at 6d. per ounce; at what price per ounce must I sell the rest that the gain on the whole may be 10 per cent.?

15. A piece of work must be finished in 36 days, and 15 men are set to do it, working 9 hours a day; but after 24 days it is found that only three-fifths of the work is done. If 3 additional men are then put on, how many hours a day will they all have to labour in order to finish the work in time?

English History and Modern Geography.

Time allowed—3 *hours.*

1. *Either* give an account of Cæsar's invasion of Britain, *or* relate, in order, the leading events in the reign of Alfred.

2. Name the sons of Henry II. who came to the throne, and an account of the reign of *one* of them.

3. State the main objects aimed at by (*a*) the Magna Charta, (*b*) Statute of Mortmain, (*c*) Provisions of Oxford, (*d*) the Self-denying Ordinance. Give particulars of one of these.

4. What were the causes which led to the Wars of the Roses? In whose reign did they begin, and when and how did they come to an end?

5. Write short notices (about five lines each) of three of the following: Cardinal Wolsey, Lord Strafford, Duke of Monmouth, Lord Clive, William Pitt, Duke of Wellington.

6. What colonies were acquired by Great Britain during the eighteenth century (1700–1800)? Give some particulars of the taking of Jamaica, Gibraltar, or Quebec. (*One only.*)

7. Give the situation of the following places, and state what remarkable events have happened at or near them:—Lewes, Cressy, Barnet, La Hogue, Blenheim, Trafalgar, Boston, Delhi.

8. Compare the climate of the West of England with that of the East, and account for the difference.

9. In what parts of the British Isles are the following manufactures carried on: *cotton*, *woollen*, *linen*, *iron*, *earthenware*? Name one town connected with each of these manufactures.

10. Describe the situation of six of the following places, and state what you know about those you select:—Portsmouth, Berlin, Hyderabad, Lyons, Cork, Brindisi, Wellington, Toronto, Sydney, Chicago.

11. Name (*a*) the colonies into which Australia is divided, (*b*) the principal towns in each colony, (*c*) the most important productions of each colony.

12. Draw an outline map of Africa or India, showing the chief physical features and position of eight large towns.

English Grammar and Composition.

Time allowed—3 *hours.*

1. Parse fully the following sentence:—'Ruin appeared impending and inevitable, though no one could tell in what precise form it would come.'

2. Analyse:—

(*a*) 'Full many a gem of purest ray serene,
The dark unfathomed caves of ocean bear.

(*b*) 'The excitement had reached a climax, when the door being opened, a man of wild and disordered appearance, which betokened his state of mind, rushed into the room.'

3. What is an *abstract* noun? In what different ways can *abstract* nouns be formed from *common* nouns? Give one example of each.

4. Define *case*. In what different ways is case denoted in English? Give the possessive singular of *boy*, *fox*, *she*, *James*, *who*, *conscience*.

5. Distinguish between *pain* and *pane*, *human* and *humane*, *hail* and *ail*. Write short sentences introducing these words.

6. Form sentences to show the different uses of the words *for*, *only*, *that*, mentioning in each case the part of speech that the word is.

7. Point out the prefixes and affixes in the following words, and show how they affect the meanings of the words:—*Extract*, *unable*, *contradict*, *antipathy*, *bicycle*, *lancet*, *blackish*, *thimble*, *sweeten*, *godly*.

8. Paraphrase the following passage, using only simple words and phrases, so as to show clearly you understand the meaning:—

'Beneath the castle's sheltering lee,
They stayed their course in quiet sea.
Hewn in the rock, a passage there
Sought the dark fortress by a stair
So straight, so high, so steep,
With peasant's staff one valiant hand
Might well the dizzy pass have manned,
'Gainst hundreds armed with spear and brand,
And plunged them in the deep.'

9. Correct the following sentences, giving your reasons:—

(*a*) Neither William or John were there.
(*b*) She was going to have written a letter to the brother.
(*c*) It is not me he injures so much as himself.

10. In the following passage supply the necessary capital letters, and put in the stops, etc., where necessary:—

an idle young chicken watching some ducklings in a round pond determined to try to swim like them in vain her mother warned her she would be drowned my feet said the chicken are as fit for swimming as the feet of this duckling by my side see he has jumped into the pond and has swum across why should not i swim as well as that duckling saying these words the foolish creature jumped into the water but she soon found her mothers warning was true.

11. Write a short essay on one of the following subjects:—

(*a*) The invention of Printing.
(*b*) A walk through the streets of London.
(*c*) Some act of heroism of which you have read or heard.
(*d*) 'Delays are dangerous.'

DRAWING (BOYS).

Time allowed—2 hours.

Freehand.

Candidates are required to copy in pencil carefully the printed sample, increasing the height about two inches, and the width in proportion. No ruling or measuring of any kind is allowed.

This test has been reduced to about one-half the dimensions of that given at the examination.

Geometrical.

(*The construction must in each case be fully shown.*)

1. In a given straight line A B to find find the point P which shall be equidistant from the two given points C and D.

2. Construct a triangle A B C; the angle A C D 60°, the side A C 2 inches, and the sum of the other two sides 4½ inches.

3. Construct an irregular hexagon, the adjacent sides of which are 1 inch, 1¼ inch, and 2 inches respectively, and the opposite sides equal and parallel.

NEEDLEWORK.

Time allowed—2 hours.

Directions.

(*To be read through carefully by the Candidate before beginning work.*)

Only two of the exercises must be attempted, but higher marks will be given for each of the Exercises B and C than for Exercise A.

The piece of calico marked A must be used for Exercise A.

The piece of calico marked B must be used for Exercise B.

The two pieces of calico marked C, and the small piece marked Cc, must be used for Exercise C.

Questions.

1. *Exercise A.*
   Hem two adjacent sides of the piece of calico marked A, showing a corner.

2. *Exercise B.*
   Turn down the calico marked B, and make a hem one inch wide. Above the hem run two tucks, each a quarter of an inch wide when finished.

3. *Exercise C.*
   Sew and fell together two inches of the two pieces of calico marked C; put in the small piece marked Cc as a gusset, as for the body of a shirt, and stitch it across.

QUESTIONS SET AT THE INTERMEDIATE EXAMINATION.

ANIMAL PHYSIOLOGY.

Time allowed—2 hours.

1. Mention the principal peculiarities of the divisions of the animal kingdom known as (*a*) Radiata, (*b*) Mollusca.

2. State exactly how expired air differs from inspired air, and explain how these differences can be proved.

3. Explain briefly the meaning of the following terms:—*vital property, sensibility, contractility, tissue, reflex action.*

4. Show how bones act as levers.

5. State what you know of the structure of the stomach, and of the changes which food undergoes in it.

6. Describe the differences in function between arteries and veins. What differences in general structure are associated with these differences in function?

7. Describe the act of respiration, with special reference to the muscles employed.

8. Describe the valves of the heart, and the manner in which they work.

9. What is the diaphragm, and how does it act?

10. What is meant by 'coagulation of the blood'? How is it brought about?

ELEMENTARY SCIENCE.

Time allowed—2 hours.

1. Explain the following terms:—*density, friction, expansion, centimetre, gramme, specific gravity.*

2. Describe any experiments you have seen, to prove that the atmosphere exerts pressure.

3. What do you understand by the expressions *hard* and *soft* water? How can hard water be softened?

4. By what expressions could you show that, as a rule, bodies expand when heated? What exceptions can you mention?

5. Describe the construction of a thermometer, and the manner in which it is graduated.

6. Explain the construction of the common pump (*diagram*). How do you account for there being a limit to the height to which water can be carried by it?

7. A sportsman is spearing a fish swimming 6 feet below the surface some distance away from him. Show by a diagram in what direction he must aim, and explain your figure as fully as possible.

8. What is meant by *specific* heat? A pound of iron and a pound of lead, both at 100° C., are placed on a block of ice. Which metal sinks furthest into the ice, and why?

9. A boy who parts his hair on the left side stands before a plain mirror. Explain fully why his image has the hair parted on the right side (*diagram*).

10. Explain the construction and mode of charging a Leyden jar.

MECHANICS.

Time allowed—2 hours.

1. What is meant by *elasticity?* How can you prove by experiment that ivory is elastic?

2. A boy throws a stone weighing ½ lb. with an initial velocity of 100 feet per second; a rifle projects a bullet weighing 1 oz. with an initial velocity of 8,000 feet per second. Compare the impulsive force of the gunpowder with that of the boy.

3. What is a wedge? Name three common tools which act as wedges.

4. Explain the position of the fulcrum in *nut-crackers, bellows, oar of a boat, wheel-barrow, tongs.*

5. Describe how you can get the true weight of a substance (*a*) with a balance with unequal arms, (*b*) with a balance whose scale-pans are of unequal weight.

6. Describe and sketch a system of pulleys on which (neglecting the weight of the pulleys) a power of 10½ lbs. would balance a weight of 84 lbs. Show how far the power must move in order to raise the weight 3 feet.

7. How can you determine the specific gravity of a substance heavier than water?

8. A body is dropped from a given point, and one second after a similar body is dropped from the same point. Find the distance between them when the first body has been falling for five seconds.

9. What is Newton's Third Law of Motion? Describe some experiments illustrating it.

10. Explain how the parallelogram of forces can be proved experimentally.

(*To be continued.*)

OUR TUTORIAL SECTION

LONDON MATRICULATION.

June 1898.

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LATIN.

Course for November.

1. *Vergil, Aeneid*, Book I., lines 398 to 600.

2. *Grammar.*—The Numerals and Pronouns in the Accidence; in the Syntax, the Accusative and Dative Cases. Note the definition of a Transitive Verb.

3. 'Anglice Reddenda,' Nos. 51 to 65.

4. Sentences to be worked from Bradley's 'Arnold' or Bayfield's or Allen's 'Exercise Book.'

Notes on Grammar.

The numerals, cardinal, ordinal, distributive, and adverbial, are most important. Note that distributives are used (*a*) to denote 'so much a piece,' (*b*) with nouns that have no singular, or that have a different meaning in the singular, as *bina castra*, 'two camps,' *duo castra*, 'two forts.' (*c*) In multiplication, as *bis dena sunt viginti*, 'twice ten are twenty.' Be able to give a list of the numerals that are (*a*) declinable, (*b*) indeclinable, (*c*) sometimes declinable and sometimes indeclinable, like *mille*. Note that *unus* is used in the plural with words plural in form but singular in meaning, as *una castra*, 'one camp.' Distinguish *triceni* (30 apiece) and *trecenti* (300 apiece). Master the declension of the pronouns, and learn the distinctions between (*a*) *quis* and *qui*, (*b*) *quid* and *quod*.

It is very important to know the classes of verbs that govern the *dative*, as English equivalents of most of these verbs are transitive. Note as well, that if the verb in the active does not govern the accusative case it is used impersonally in the passive; hence *persuadeo tibi*, 'I persuade you,' becomes in the passive *tibi persuadetur*, not *persuadeor*.

Among the verbs governing the dative the following are most important, and students should be able to construct sentences showing their construction:—*Consulo, impero, invideo, credo, minor, adimo, resisto, pareo, parco, subvenio, aemulor, placco, expedit, licet, persuadeo, auxilior, indulgeo, faveo, nubo.* The first five of these verbs also allow the accusative under certain circumstances; for examples see the grammar. The verbs *iubeo, laedo, delecto, sino*, etc., which, contrary to the general rule, govern the accusative, are important.

Contrast '*te iubet hoc facere*' and '*tibi imperat ut hoc facias*,' 'he orders you to do this.' Be able to give a definition and example of the following terms:—*Ethical dative, predicative dative, adjectival dative, double dative* (*i.e.*, the *dative* of the person and the *predicative dative* in combination), *dative of advantage* or *disadvantage* (*dativus commodi* and *incommodi*), *cognate accusative, accusative of space* and *time, adverbial accusative, accusative of respect.* Note that the dative of the agent is used with the gerundive.

Learn the classes of verbs that can have two accusatives depending on them, and note what becomes of these two accusatives in the passive. The verbs of asking that do *not* take two accusatives should be known, *e.g.*, *peto, postulo, quaero*, etc.; '*hoc a te peto*,' 'I ask you for this.' Note how 'ago' is expressed by *abhinc* and accusative, as *decem annos abhinc*, 'ten years ago.'

Learn a list of the prepositions that govern the accusative. Note the rule for expressing 'motion to,' which we have already given in solving sentences.

Solution of Sentences given Last Month.

1. Se milites interfecturum (esse) minatus Capuam quam celerrime iter fecit (contendit).

2. Nemo amicum tuum (vestrum) rogaverat cur Romam ivissemus.

3. Cur militibus pepercerimus nemo ei debet dicere.

4. Quando cum amico suo abiverit tibi dicere non possum.

5. Nostrum quisque te (vos) Romae quindecim dies manere audivit.

6. Cum fratrem tuum Syracusis manere audivisset (*or* postquam . . . audivit) hoc tibi dicere constituit.

7. Militum quisque se hunc convenisse dixit.

8. Quis se patri tuo hoc dicturum minatus est?

9. Quis se patri tuo hoc dicturum minatus esset rogavimus.

10. Fratrem tuum (vestrum) cur Roma Athenas ivisset rogare poterat.

Typical Sentences.

7. Balbus had asked your brother to form this plan.

Balbus fratrem tuum rogaverat ut hoc consilium iniret.

Notes.—(*a*) Whenever 'to and the inf.' in English expresses a purpose, the *inf.* must *not* be used in Latin *prose*. One of the commonest ways of expressing the *inf.* in such cases is by using *ut* (= in order that) and the subjunctive. If the *inf.* has a negative attached to it, *ne* is used instead of *ut*. *E.g.*, *te rogavi ne hoc faceres*, 'I asked you not to do this.' From this we deduce the following rule: After verbs denoting 'ask,' 'command,' 'persuade,' 'advise,' and 'strive,' and similar verbs, 'to and the inf.' are translated by *ut* and the subjunctive. (*b*) For the tense of *iniret*, see Ex. 4, last month. The action of 'forming the plan' is future to that of 'asking,' hence the imperfect subjunctive is used.

8. Let each of us prevent him from sacrificing his own interests to those of his country.

Nostrum quisque eum prohibeat quominus patriam suam sibi anteponat.

Notes.—(*a*) For *nostrum*, see 6 (*a*). (*b*) Verbs of preventing when followed in English by *from* and a *verbal noun* are generally followed in Latin by *quominus* ('by which the less') or *ne* ('lest'), with the subjunctive. *Obstare* also means to prevent, but unlike *prohibeo*, which is a transitive verb, governs the dative. (*c*) Beware of looking out in the English-Latin Dictionary and writing down a literal translation of 'sacrifice.' Metaphor must be treated cautiously in Latin, and it is better for the beginner to avoid retaining the metaphor in his Latin version. Turn the metaphor into unmetaphorical English. Applying this process to this sentence we get as a result 'to prefer one's country to oneself'; 'to prefer' in this sense is *antepono*. (*d*) *Country* as opposed to 'town' is *rus*: in the sense of native land is *patria*.

9. No one doubted that so brave a man as Balbus ought to have gone to the camp at Capua without delay.

Nemo dubitavit quin Balbus vir fortissimus Capuam ad castra sine mora ire deberet.

Notes.—(*a*) After negative or virtually negative verbs of doubting, *quin* with the subjunctive is used to express 'that.' A rough rule for the general use of *quin* is this: whenever 'but that' can be used in English, then *quin* can be employed in Latin. (*b*) Many students will translate 'so brave a man as Balbus' by 'tam fortis vir quam Balbus.' Now *tam . . . quam* are used only when there is a comparison drawn between two people. In this sentence this is not the case, and in this and in similar instances the *superlative* is used. Note also that *fortissimus Balbus* would not be good Latin; adjectives are not used with proper names except the words *vir, femina*, etc. are also employed. (*c*) In English we use the prepositional phrase 'at Capua' as an adjunct of the noun 'camp'; in Latin this is not done, and the Latins attached the phrase to the verb, and said 'to Capua, to the camp.' For the accusative, see 2 (*c*). (*d*) Note the tense of the inf. *ire*. After *debeo, possum*, etc. the perf. inf. is not used, though the English equivalents of these verbs, *ought, could*, are followed by the perf. inf. The action of the 'going' and the action of *debeo* are synchronous, therefore the pres. inf. is used; see 1. In English, as *ought* is present and past, the past signification has to be expressed by using the perf. inf. This is not necessary in Latin, as *debeo* has a past tense.

Sentences for practice, solutions of which will be given next month:—

1. We had no doubt that it was all over with (*actum esse de*) the army.

2. After promising to retreat (*se recipere*) to the camp at Lyons (*Lugdunum*), he broke his word (*fallere fidem*) without consulting the general.

3. There is no doubt that he is making it his aim (*id agere*) to govern (7 (*a*)) the kingdom with wisdom and justice. (Use adverbs.)

4. No one could have prevented us from making an attack (*impetum facere in*) on the enemy, who were not far distant.

5. On hearing that Cæsar had pitched (*pono*) his camp near (*prope*) the city, he determined to stop in Rome for twelve days.

6. Which of us can prevent so turbulent soldiers as these (= these so turbulent soldiers) from laying waste (*vasto*) the territories of the Etruscans?

7. They say that the general had ordered the soldiers to retreat to the woods.

8. We have advised (*moneo*) our friends to place no credence (*credo*) in so base (*turpis*) a man as Marcus.

9. We ought to have persuaded (*persuadeo*) the soldier to give up (*trado*) his arms at once and to march to the nearest (*proximus*) town.

10. No one told me that you hoped to go to your father at Rome in ten days' time.

Notes on Vergil.

309. *Haud* is the negative used with adjectives and adverbs.
409. *Veras voces*, 'the language of reality.'
419. *Urbi.*—Note the dative depending on *imminet.*
421. *Magalia*, unusual word. Readers should collect in a note-book all the unusual words occurring in the set books.
422. *Strata viarum.*—Graecism.
423. *Ducere muros*, 'build the walls.' Note the *constructio ad unum*, *pars* singular, and *instant* plural.
425. *Optare*, 'choose'
440. *Ulli.*—Dat. of agent, found in prose generally dependent on the gerundive.
441. Note the gen. *umbrae.*
445. *Victu.*—Abl. of respect.
454. *Sit.*—Subjunctive in a dependent question.
455 *Artificumque manus inter se*, 'the skill of the rival artists' (Conington).
462. Line 462 very important. 'Here, too, there are tears for human fortune, and hearts which are touched by mortality' (Conington).
475. *Impar congressus Achilli*, important.
480. *peplum*, unusual word.
504. *instans*, used in two different senses with *operi* and *regnis.* This figure of speech is called *zeugma.*
527. *Populare*, poetical use of the inf. to express a purpose (Graecism).
531. *Armis.*—Abl. of means.
540. *Hospitio.*—Abl. of separation.
541. *Prima terra*, 'on the edge of their territory' (Conington). Abl. of 'place where' without a preposition.
544. Note the omission of the negative before *iustior.*
552. *Stringere remos*, *i.e.*, 'strip branches and make them into oars.'
560. Note the short lines occurring here and there. Vergil did not live to revise the poem thoroughly.
565. *Troiae urbem.*—In prose we would find generally *urbem Troiam.* The name of the town is in prose generally put in opposition to the noun, and not put in the genitive (of definition).
573. *Urbem.*—Note this strong case of attraction of the antecedent into the case of the relative.
580. *Erumpere nubem.*—Poetical use of the acc. In prose we should find *e nube erumpere.*
589. *Os humerosque.*—Acc. of respect (Graecism).

FRENCH.

Course for November.

1. A certain amount of translation and a certain number of exercises from English into French each week.

2. In Grammar learn the rules for the comparison of adjectives. Learn the numerals, the names of the months and the days of the week: the methods of expressing time. Learn the personal pronouns.

In the numerals note the rules for *vingt* and *cent.* Note that *mil* is used for *mille* in dates of the Christian era. Note *le onze.* Distinguish *deuxième* and *second.* Note *deux heures et demie*, but *midi et demi. Demi* does not change in the latter case through attractions to the gender of *midi.* Note that 1898 can be expressed in two ways, either *mil huit cent quatre-vingt dix-huit*, or *dix-huit cent quatre-vingt dix-huit.* Distinguish *Charles quint* and *Charles cinq.* Know when cardinal numbers are used in French while we use ordinals. Be able to give a list of the personal pronouns (*a*) conjunctive, (*b*) disjunctive. Be able to give examples of their usage. Learn the rules for the position of conjunctive pronouns relative to the verb, and also for their position relative to each other. Note the uses of *en*, *y*, and the pleonastic *le.* Be able to frame sentences illustrating these rules.

ENGLISH.

Course for November.

Grammar.—Adjectives.

History from the death of William the Conqueror to the death of John.

English Notes.

History.—A description of the character of the various monarchs is often required. Lives of Lanfranc and Anselm are important. The Investiture dispute, in which the latter was involved, is very important. The claims to the throne of William II., Henry I., and Stephen should be known. The causes and results of the Crusades, with an account of the Crusades in which the English took part, should be mastered. Note the character of Henry I., his war with Robert, and the Battle of Tinchebrai. The perfection of the Conqueror's System by Henry I. should be known. Note the *Commune Concilium Regis*, the *Curia Regis*, the origin of Itinerant Justices and the Court of Exchequer. Note the progress of the Civil War in Stephen's reign, the Battle of Northallerton, and the state of England at that period. Note how Henry II. restored order when he ascended the throne, and succeeded in keeping down the powers of the barons, and the power of the Church. The life of Becket is most important, involving as it does the struggle for power between the King and the Pope. The various legislative enactments, viz., the Statute of Clarendon, the Assizes of Clarendon, the Assize of Northampton, and the Assize of Arms, should be learnt. Note Scutage., the Inquest of Sheriffs, Recognitors, the germ of Trial by Jury. The Continental possessions of Henry II. should be known. Be able to discuss the Conquest of Ireland. The Battle of Alnwick and the Treaty of Falaise are important, on account of the claim to the supremacy of Scotland afterwards put forward by Edward I. In Richard's reign note the massacre of the Jews, the selling of the sovereignty of Scotland, the Third Crusade, the revival of Danegelt under the name of Carucage. In John's reign his quarrel with the Pope and barons is most important. Note also the loss of Normandy, and be able to discuss the effect of this on the union of English and Normans in England. Be able to give an account of Stephen Langton. Know thoroughly the provisions of the Magna Charta. Note the Battle of Bovines, and the Army of God and the Holy Church.

Grammar.—In this month's course attention should be paid to the following points:—Definition and classification of adjectives; the use of adjectives as attributes and predicates; reasons for and against regarding the article as a distinct part of speech; the advantages accruing to a language from the possession of articles; the derivation of numerical adjectives, especially twain, third, five, nine, ten, eleven, twelve, dozen, thirteen, twenty, score, hundred, million, myriad; the comparison of adjectives, regular and irregular; instances of double comparatives and double superlatives; comparison formed by vowel changes; comparatives formed by false analogy, *e.g.*, 'farther'; adjectives that do not admit of comparison; discussion of the correctness of comparing words like 'perfect,' 'golden,' etc.; discussion of phrases like 'the largest circulation of any Liberal newspaper'; 'Eve, the fairest of her daughters'; 'more better' (Tempest); 'many a flower'; 'a few books'; 'the three first books'; 'our mutual friend'; 'a talented man'; 'a reliable person'; 'every other day'; 'the most unkindest cut of all.'

MATHEMATICS.

Geometry Course.

The Second Book of Euclid should be read this month, and at the same time the propositions of Book I. should be revised.

Get up the algebraic equivalents of propositions 1 to 11 inclusive; it is, perhaps, also useful to learn by heart the enunciations of 4, 5, 6, and 7.

The following are the solutions to last month's riders:—

1. In proving this we shall make use of theorem (1) given in Section IV. of Hall and Stevens' theorems, and examples on Book I. on page 96 of their 'Euclid.'

Construction.—Through D draw DG parallel to BF, cutting AC in G.

Then in triangle CBF we have CD = DB, and DG parallel to BF.

$$\therefore CG = GF.$$

Again, in triangle ADG, EF is parallel to DG, and AE = ED.

$$\therefore AF = FG.$$

Hence AF = FG = GC.

In connection with the above, note that we have trisected the line AC.

2. Take AB as a side of the given square, and draw BC perpendicular and equal to AB; join AC.

Then square on AC = twice square on AB.

Again, draw CD perpendicular to AC and = AB ; join DA.

Then square on DA = sum of square on AC, CD
= three times square on AB.

3. $1\frac{1}{2}$ right-angles.

We add a few riders :—

1. If D be the middle point of the base BC of a triangle ABC, prove $BA^2 + AC^2 = 2AD^2 + 2DC^2$.

2. What is meant by a median ? In any triangle show that the sum of its medians is less than the sum of its sides.

3. Divide a line externally, as in II. 11.

Arithmetic Course.

Chapters XXI., XXII., XXV., and XXVIII. of Pendlebury should be read, and plenty of examples worked.

Note the importance of decimals in Practice sums, and how all long Compound Multiplication sums can be done by Practice ; thus : to multiply £27 3s. 6½d. by 1,273 is the same as finding cost of 1,273 articles at £27 3s. 6½d. each.

The answer to the question set last month is ·07 cm., or as the first three places are ·077, and as we want the nearest approximation, we should call it ·08 cm.

We append some questions :—

1. Multiply £13 13s. 7½d. by 4,273.

2. Find the square of 14275432 as far as the tens of thousands.

3. Bring $\frac{1}{19}$ into a decimal fraction.

Algebra Course.

Chapters XVIII., XIX., and XX. of Hall and Knight are to be read up, and every third example in these chapters should be worked.

Articles 146, 147, 154, 155, 156, 161, 162, 165, and 170, ought to be carefully studied.

The following are the solutions to the questions set in our last course :—

1. $(x^2 - 4x + 8)(x^2 + 4x + 8)$.

Note, we do not write $x^2 + 8 - 4x$, as this is not in descending powers of x.

$x^4 + 64 = (x^2 + 8)^2 - 16x^2 = (x^2 - 4x + 8)(x^2 + 4x + 8)$, as before.

2. $(3x + y - 5)^3 - (2x + 2y - 5)^3$ will factorise, being of the form $a^3 - b^3$. Its factors are :—

$$[(3x + y - 5) - (2x + 2y - 5)][(3x + y - 5)^2 + (3x + y - 5)(2x + 2y - 5) + (2x + 2y - 5)^2]$$

$= (3x + y - 5 - 2x - 2y + 5)$ (the other factors written above)

$= (x - y)$ (the other factor)

$= 0$; since $x = y$, and hence the factor $x - y = 0$.

3. $x^6 + x^5 - x^4 - x = x^5(x^2 - 1) + x(x^4 - 1)$

$= x(x^2 - 1)(x^3 + x^2 + 1)$

$= x(x - 1)(x + 1)(x^3 + x^2 + 1)$.

$x^5 - 1 = (x^3 - 1)(x^3 + 1)$

$= (x - 1)(x + 1)(x^2 + x + 1)(x^2 - x + 1)$.

Hence $\dfrac{x^6 + x^5 - x^4 - x}{x^5 - 1} = \dfrac{x(x^3 + x^2 + 1)}{(x^2 + x + 1)(x^2 - x + 1)}$.

4. Solving $a + b = x$, and $a - b = y$, we get—

$$a = \frac{x + y}{2} ; \; b = \frac{x - y}{2}.$$

Hence $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

$$= \left(\frac{x + y}{2} - \frac{x - y}{2}\right)\left(\frac{x^2 + 2xy + y^2}{4} + \frac{x^2 - y^2}{4} + \frac{x^2 - 2xy + y^2}{4}\right)$$

$$= y\left(\frac{3x^2 + y^2}{4}\right).$$

In $5002^3 - 4998^3$ we have $a = 5002$, and $b = 4998$.

$\therefore x = a + b = 10000 = 10^4$.

$y = a - b = 4$.

Now $a^3 - b^3 = y\left(\dfrac{3x^2 + y^2}{4}\right) = 4\left(\dfrac{300000000 + 16}{4}\right)$

$= 300000016$.

We append a few examples :—

1. Divide $b^3 + c^3 - 1 + 3bc$ by $b + c - 1$.

2. Write down the square of $a^3 - 3a^2 + 1$.

3. Factorise $x^{12} - y^{12}$.

Mechanics Course.

Chapters XV. and XVI. of Loney up to Article 218 should be read, and plenty of the examples worked, at the same time the previous work should be kept up by working a few of the back examples. Articles 196, 197, 200, 201, 203 are important.

Note that the kinetic energy of a body mass m is $\frac{1}{2}mv^2$; if m is measured in lbs., and v in feet and seconds, the product $\frac{1}{2}mv^2$ is in foot-poundals ; if the m be in grammes and the v in centimetres and seconds the $\frac{1}{2}mv^2$ is in centimetre-dynes or ergs.

Thus the energy of a body of 10 tons moving at rate of 60 miles an hour may be found thus :—

$m = 10$ tons $= 22400$ lbs.

$v = 60$ miles per hour $= 88$ ft. per sec.

energy $= \frac{1}{2}mv^2$ foot-poundals

$= \frac{1}{2} \times 22400 \times 88 \times 88$ foot-poundals

$= \dfrac{22400 \times 88 \times 88}{32 \times 2240}$ foot-tons

$= 4840$ foot-tons.

We append some illustrative examples :—

1. A gun of mass 100 tons discharges a shot 100 lbs. at a rate of 400 feet per second ; find the energy of the shot and of the gun.

First, to find the velocity of recoil of the gun, say v ft. per second.

Momentum of gun = momentum of shot.

$\therefore 224000v = 40000$.

$\therefore v = \frac{40}{224}$ ft. per sec.

$= \frac{5}{28}$ ft. per sec.

energy of shot $= \frac{1}{2}mv^2 = \frac{1}{2} \times 100 \times 400^2$ foot-poundals

$= \dfrac{50 \times 160000}{32}$ ft.-lbs.

$= 250000$ ft.-lbs.

energy of gun $= \frac{1}{2} \times 224000 \times \frac{5}{28} \times \frac{5}{28}$ ft.-poundals

$= 2040$ ft.-poundals approximately

$= 64$ ft.-lbs. approximately.

2. A balloon is travelling horizontally at a speed of 20 ft. per sec. and a stone is let fall. If the stone take 5 seconds to reach the ground, how far from the spot below the original position of the balloon does it reach the ground ? (Neglect resistance of air.)

Here the stone moves with an initial horizontal velocity of 20 ft. per second, and with a vertical downward acceleration of 32 ft. per second ; the former velocity will keep constant throughout the motion.

Now since the motion lasts for 5 seconds, the stone will travel a horizontal distance of 5 times 20, or 100 feet.

3. In what direction should a person who can row 12 miles an hour steer in order to get straight across a stream flowing at rate of 6 miles an hour ?

It is clear that he must row somewhat against the current, say at an acute angle θ with the bank. Resolve his velocity of 12 miles an hour into

12 cos θ up the stream or against the current,

12 cos $(90 - \theta)$ or 12 sin θ perpendicular to the former.

The former 12 cos θ must counteract the current, so that we get

$$12 \cos \theta = 6,$$

leading to $\theta = 60°$.

The latter 12 sin θ, or $\frac{12\sqrt{3}}{2} = 6\sqrt{3}$ miles per hour, will take the boat across, so that if the stream were 440 yards wide the time taken in crossing = 440 yards ÷ velocity in yards per hour

$= 440 \div (6\sqrt{3} \times 1760)$ hours

$= \dfrac{1}{24\sqrt{3}}$ hours

$= \dfrac{5}{2\sqrt{3}}$ minutes.

$= \dfrac{5\sqrt{3}}{6}$ minutes.

This problem could also be done perhaps better by the triangle of velocities.

Let A and C be two places exactly opposite each other, and AB, DE the two banks.

Take AB = 6 inches to represent the current in direction and magnitude.

With centre B and radius 12 inches, describe a circle cutting AD in C. Complete the parallelogram ABCF.

The AF is the direction he must take.

For AF, AB represent the two velocities possessed by the boat, and since ABCD is a parallelogram, AC will be direction of the resultant.

4. A stationary engine of 96 H.P. is used to draw a mass of 12 tons up an incline of 1 in 6, the frictional resistance, etc. being 8 lbs. per ton; find its maximum velocity.

Here the force opposing the motion is due to two causes:—

(*a*) $12 \times \frac{1}{6}$ or 2 tons = 4480 lbs. due to the hill,

(*b*) 8×12 or 96 lbs. due to resistance,

yielding a total force against which work is done of 4576 lbs.

Let v feet per min. = required maximum velocity.

Then work done per min. by the engine = $4576\ v$ ft.-lbs.

But the engine being of 96 H.P.

Work done per minute = 96×33000 ft.-lbs.

$$\therefore 4576\ v = 96 \times 33000$$

leading to $v = 692\frac{4}{13}$ ft. per sec.

5. With what velocity must a particle be projected horizontally from the top of a tower 100 ft. high in order to strike the ground at an angle of 45°, and how long does it take to reach the ground?

To find the time taken to reach the ground we have to find the time taken to fall 100 ft. vertically, for the initial velocity being horizontal will not affect the time of falling.

By formula $s = \frac{1}{2}gt^2$

we get $100 = 16t^2$

or $t = 2\frac{1}{2}$ sec., giving the time taken.

By formula $v = gt$ we get $v = 80$ ft. per sec. as the vertical velocity possessed by the particle when striking the ground.

In order to strike the ground at angle 45° the horizontal component of its velocity on striking must be the same as its vertical component, which we have found above to be 80 ft. per sec.; this therefore must have been its initial velocity, as the horizontal component of the particle's velocity is unaltered during the whole of the motion.

We add, as we did last month, a few book-work questions:—

1. What is meant by 'the physical independence of forces'? Illustrate the meaning with examples.

2 Prove clearly, without assuming any formula for kinetic energy, that the work required to stop a mass m grammes moving at the rate of v cm. per sec. is $\frac{1}{2}mv^2$ ergs.

3 Would 2 be modified if the body were falling vertically at the rate of v cm. per sec.?

4 Taking into account the resistance of the air, prove that a body thrown vertically up takes longer in falling than in rising.

5. Define work, energy, and horse power.

6. What is the H. P. of an engine that pulls a train of 100 tons at the speed of 45 miles an hour up an incline of 1 in 100, the frictional and other resistances being 8 lbs. per ton?

CHEMISTRY COURSE.

It should be noticed that the hydrogen prepared by the ordinary method of acting on zinc with sulphuric acid is never pure; it has a faint odour. When pure it is without smell. In order to purify it, it may be passed through a solution of potassium permanganate; pure H may also be prepared by heating a mixture of zinc dust and slaked lime, when the following reaction takes place:—

$$Zn + Ca(OH)_2 = ZnO + CaO + H_2.$$

Having mastered the preparation and most important properties of O and H, the best and most natural course is to study water, which is formed from these elements.

The composition of water as determined by volumetric and gravimetric methods should be well mastered. The hardness of tap water, temporary and permanent, should be studied, and the method of removing it.

CHANGES IN THE LONDON UNIVERSITY REGULATIONS.

Matriculation.

IN 1899 new regulations will come into force which will change considerably the style of the examinations. It is difficult, of course, to tell what the exact effect will be which these modifications will produce. So far as can be judged from the syllabus, the examination will in some ways be easier, and in others harder. Some people who have written to the educational papers on this subject seem to be under the impression that the examination will be more exclusive than hitherto; but in the Matriculation, at any rate, the lessening of the number of subjects must have a contrary effect, even if the standard is raised in the obligatory subjects. I shall briefly mention some of the more important changes, full details of which can be obtained on application to the Registrar of the London University, Burlington House, W. The changes in the Matriculation are as follows: Candidates will be required to show a competent knowledge in five subjects. Every candidate must take (1) Latin, (2) English, (3) Mathematics, (4) General Elementary Science (2 papers), and one of the following subjects—Greek, German, French, Sanscrit, Arabic, Mechanics, Chemistry, Sound and Heat and Light, Magnetism and Electricity, Botany. Two papers will be set in Latin as heretofore, but each paper will be of three, instead of two, hours' duration. Otherwise there is no change in the Latin. General Elementary Science will consist of elementary questions on Mechanics, Heat, Light, Sound, and Chemistry. In the French paper there will be an innovation. An easy piece of English will be set to be turned into French.

Int. Arts Examination.

In the Intermediate Arts Examination candidates will be offered a choice between Mathematics or Logic. The only change in the Latin syllabus is the statement that in addition to a general knowledge of the outlines of Roman History to the death of Julius Cæsar, a detailed knowledge of a special period will be required. It is in the Greek and French that the greatest changes are made. At present only one Greek author is prescribed each year, and only one paper is given. In 1899 two authors are prescribed and two papers will be set. Candidates will also be required to show the same knowledge in Greek History as in Latin. Simple passages of Greek will be given to be turned into English, and short sentences in English to be turned into Greek. These changes will make the examination more difficult it is true, but, on the other hand, there will not be such a wide difference as now between the Intermediate Arts and B.A. Greek Examination. In the French, translation of a piece from English into French will be required, and candidates will be required to read a passage of French aloud, with *viva-voce* questions thereon.

B.A. Examination.

In the B.A. Examination, Latin and Greek, as at present, are obligatory. Candidates are to select in addition two of the following subjects—(1) English; (2) French, German, Italian or Sanscrit; (3) History; (4) Mathematics, Pure or Mixed; (5) Mental and Moral Science; (6) Political Economy. Candidates who take Mental and Moral Science have first to pass the Intermediate Arts Examination in the subject, but not necessarily at the time of passing the full Intermediate Arts Examination. Candidates who take French and German Honours are excused from taking other optional subjects.

In the Latin and Greek papers, easy passages of English will be given for translation into Latin and Greek respectively.

In French and German, general outlines of French literature will be required, with more detailed knowledge for a specified period. Reading aloud will also be required.

Hitherto candidates who presented themselves for Honours had to present themselves first for the pass examination, now they will not be allowed to take the Pass and Honours paper in the same subject.

Int. Science and B.Sc.

From 1899 candidates for the Intermediate Science will have to present themselves only in three of the following subjects—(1) Mathematics, Pure and Mixed; (2) Biology; (3) Chemistry; (4) Physics.

In the B.Sc. Examination, Mental and Moral Science will no longer form one of the subjects. The syllabus in the other eight subjects is given with greater fulness than before. A candidate for Honours may, at his option, be examined in two only out of the eight subjects of the examination, by means of the Honours Papers in one of such selected subjects and the Pass (or Honour) Paper in the other, provided that he shall obtain First Class Honours in one subject, and First Division (Pass) or be classed in Honours in the other.

Candidates for the B.Sc. must not only obtain pass marks in the three subjects they select, but must also obtain a higher proportionate of the aggregate marks in these subjects.

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Head Master of the Belvedere Pupil Teachers' Centre, First on Scholarship List, Author of 'Scholarship School Management.'

PUPIL TEACHERS' COURSE.

AUTUMN EXAMINATION, 1898.

SECOND MONTH.

See MARCH NUMBER.

SPRING EXAMINATION 1898.

SEVENTH MONTH, NOVEMBER.

WORK TO BE PREPARED.

A.—*English.*

(Students are invited to write for assistance in case of difficulty not taken in the course.)

First Year.

1. Greek suffixes.
2. Prepare lines 224–247 of the 'Lay of the Last Minstrel,' with all meanings, allusions, etc.

Second Year.

1. Conjunctions—learn classification (*a*) on the basis of function, and (*b*) on the basis of meaning.
2. Tabulate all prefixes in the first 100 lines of 'The Task.'
3. Prepare lines 659–717 of the Winter Evening, 'Task,' Book IV. Pay special attention to paraphrase and learn derivations of all important words.

Third Year.

1. Learn 20 roots and meanings per week.
2. Prepare lines 539–630 of 'Comus.' Pay special attention to the paraphase and references.

(Any difficulties will be taken in the Correspondence column, or if preferred, by post.)

Notes. '*Lay of the Last Minstrel.*'

Line 225. *Rode* for the Perf. Participle *ridden*. Cf. 221, *shook* for *shaken*.
226. *Trampled*. Perfect Participle gov. by *had* understood.
227. *Neither*. Conjunction correlative with *nor* (*i.e.* had known neither remorse nor care.)
228. *Yet*. Conj. Adversative.
231. *Bewildered* and *unnerved*. Participles qual. *he*.
234. *To see the sight*. Object of the Trans. verb 'might endure.'
235. '*he had loved so brotherly*.' Adj. Sent. qual. *man*.
236. *And*. Conjunction goving. preceding with the sentence, 'Thus unto Deloraine he said.'
237. *Speed*. Usually intransitive, here transitive, taking a double object (*a*) 'Thee' = thyself; Reflexive Object, and (*b*) a Noun sentence 'What thou hast to do.'
238. *To do what*. Object of the Predicate *hast*.
239. *may rue*. Subjunctive mood.
240. '*thou mayest . . . upon*.' Adj. Sent. to *those* (a Demonstrative Pro.).
245. *as he took it*. Subord. Adv. of *Time* to *thought*.
The dead man frowned. Noun Sentence after 'thought.'
247. *Perchance*. Adverb of doubt—modifying 'had dazzled.'

General Paraphrase of '*The Task.*' (cont.)

Line 659.—Where man is allowed to develope in natural society, all his best faculties, mental and moral, appear in their fullest vigour, and he may be compared to a flower blooming in its natural soil; but when he is compelled to unite with others, either by law, or for the purposes of trade and gain, or for the purposes of war, the better qualities of his nature disappear, and all the evils seem to develop with surprising vigour; and like a handful of flowers taken from their natural surroundings and crowded into a vase, his better qualities fade rapidly, and he soon contracts unbearable corruption. Abundant evidence of this is seen in the case of public bodies of men who individually are honest, upright, and straightforward; but who united seem to become totally changed, forget such things as justice and mercy in their insatiate greed for wealth, illtreat those dependent upon them, and soil the purity of the robes of justice with the ugly stain of blood. And so the battlefield, miscalled the field of glory, dazzles the world with glittering accoutrements, martial music and parades, wreaths of victory, and all the panoply of arms; when in reality it is but a school of vice, where men are trained not to think, where foppery is considered a compensation for folly, and gallantry for vice.

Line 691.—Yet, notwithstanding the fact that the rich have deserved it, and that the manners and morals are sadly different from what they once were, the country and rural life has still great attractions for me. In all the day dreams of my youth, the scenes were laid in the country, and long before I had freedom of choice, or indeed hoped for it, my inclination drew me irresistibly to the quiet solitude of the country. Even the first attempts I made at writing poetry, when I was unconscious of any power in that exercise, the country figured largely; my favourite writers were those who depicted rural scenes, and I never tired of the pastoral writings, while the tales of the heroes of old failed to attract me in any way. Tityrus piping under his beech tree to a crowd of rustics, ranked before the labours of Hercules or the adventures of the Argonauts. Milton, indeed, appeared most strongly to my imagination. His 'Paradise Lost and Regained' was an entrancing vision, for which, boy-like, I could find no adequate raptures, and I wondered that I had deferred reading him till I was fourteen years old; and was half afraid that I had, owing to the delay, missed some of the enjoyment to be derived from the perusal.

Paraphrase of '*Comus.*' (Passages by request.)

Line 170.—If I might trust my ear, which in this darkness is my only guide, the sound came from this direction. It seemed to be the boisterous merriment and excess raised by the music of the flute or pipe amongst the uncultured rustics, when, the harvest having been safely garnered and the flocks securely folded, they dance to the great god Pan, and thank the gods in a misguided manner. I should much regret to encounter the drunken insolence and familiarity of such a rough mob.

Line 359. You do wrongly, my brother, to indulge in gloomy apprehensions as to the future, for even if your surmises should be correct, it only increases the trouble by anticipating it beforehand, and if they are not, then such self-torment is an altogether superfluous evil. I do not think my sister is so lacking in judgment, and deficient of the calm serenity which is the usual concomitant with goodness, as to be greatly alarmed either by our absence or by the mere want of light. For virtue needs no artificial light to sustain her, and would not be affected by the total loss of sun and moon. And as to being alone that should not trouble her, for it is the habit of the wise to seek such solitude, where, apart from the din and turmoil of the world, they may spend some time in undisturbed contemplation and quiet thought, and repair those defects which arise from contact with the crowded haunts of mankind. Man is not dependent on exterior circumstances for his happiness and peace, for a clear conscience illuminates the blackest moment, whereas, in the clearest and brightest day, the evil mind is surrounded by the gloom and horror which enclose it as an eternal dungeon.

Line 407. I do not reason as though my sister were in absolute safety and far removed from any danger, but where hope and fear are about equally balanced, it is always advisable to embrace the hope and banish the fear.

Lines 453–475. Absolute purity is so dear to Heaven, that when it is found in any mortal soul, she is immediately surrounded by hosts of angels who carefully shield her from contaminating influences, and breathes into her mind such high and holy thoughts as could never enter the ear of those who cling to earth. This communion with the celestial, not only affects the mind, but by degrees the outward shape and appearance is so influenced with heavenly association, as to become more and more ethereal and immortal. But on the other hand when the mind allows itself to become contaminated with evil thoughts and speech, or by the actual commission of the vilest sin, it loses its spirituality and becomes more and more brutish and carnal, till finally all the divine essence of the former existence is quite lost. And when the body dies, the spirit has become so attached to the pleasures of the flesh that, loth to leave it, it hovers round the sepulchres and graves, bound to the vile earthy things when it should be soaring upward to celestial bliss.

B.—*Arithmetic.*

First Year.

Boys.—Problems on Fractions.
Girls.—General Problems on Fractions.

Second Year.

Boys.—Problems on Stocks.
Girls.—Continued Fractions.

Third Year.

Boys.—General Problems.
Girls.—Problems on mixed agents and work. Alligation, etc.

C.—*Music.*

First Year.—Whole-pulse, half-pulse notes, continuations and rests.

Second Year.—Answer any back questions.

Third Year.—Revise musical terms and answer any back questions.

D.—*Geography.*

British N. America.—Physical Features, Climate and Productions.—It would be well to scratch an outline on a slate and practise continually till well known—fill in all the details given in the books many times. Mapping in some form or another *must* be done. Note the various divisions into which the country naturally falls:—(1) The Pacific slope. (2) The Prairie Region. (3) The Bleak and Barren North-West. (4) The basin of the St. Lawrence. (5) The Atlantic Provinces. The climate differs in each, and the vegetable production vary also.

Test Questions on Ireland.

1. Give an account of the mountain system of Ireland.
2. Describe the situation and character of Connemara and the Bog of Allen.
3. Name the seaports of Ireland, giving their characteristics and industries.
4. What connection is there between linen and flax? Where is linen made, and why is the seat of the manufacture located there?
5. Describe a voyage down the River Shannon.
6. What do you know of the climate and productions of Ireland?
7. Give one or two leading facts about, and the situation of, Londonderry, Valentia, Queenstown, Kingstown, Belmullet, Killarney.
8. Describe a coasting voyage from Donegal to Kinsale.
9. What do you know of the following: Giant's Causeway, Valentia, Avoca, Connemara, Golden Vale, Rathlin, Curragh, Trim, Carrantual, Nephin Beg.
10. Say what you can of the internal communications of Ireland.

E.—*History.*

William II., Henry I., and Stephen.

Chief points to be noticed :—
The dispute between William and Robert.
The Crusades.
The Misrule of Ralph Flambard.
The investiture dispute and its settlement. Note that this is the commencement of a long struggle by the English kings against the grasping supremacy of the Pope.
Henry's Charter.
The Civil War, Battle of the Standard, and the social state of England at this time.

F.—*Euclid.*

Second Year.—Props. 21-24, with two deductions per week.
Third Year.—Revise Book I., Props. 7-20, with four deductions per week.

G.—*Algebra.*

Simple Equations of one unknown.

H.—*Teaching.*

Second Year.—Chap. VI. 'Scholarship School Management.'
Third Year.—Chap. XIII. Discipline, etc. Finish Chapter and look up answer to questions at end of Book.

QUESTIONS TO BE ANSWERED.

1. *Penmanship.*
(*a*) Largehand—Qualifying, Rhinoceros, Supremity.
(*b*) Smallhand—A palmer's amice wrapped him round.

2. Write an essay each week :—
(*a*) Cleanliness in its relation to health.
(*b*) Klondike.
(*c*) The invention and effects of printing.
(*d*) Description of sunset.

3. *English—First Year* :—
(1) Analyse Stanza XVIII., and parse *Till, like rain, at length, would, to see, far aloof.*

(2) Analyse Stanza XIX., and parse *As if, a day, some seventy winters, all unrefilled, they trusted his soul has gotten grace.*

(3) Give the root and suffix in each of the following :—Frolicsome, knotty, clayey, woollen, leeward, awkward, knavish, friendly, bootless, sweetish.

Second Year.
(1) Paraphrase lines 613-622, 635-648, 650-658.
(2) Analyse the same lines.
(3) Parse *But faster far, seem most at variance, to be whatever, grows conscious, 'Twere well, to break some.*
(4) Make a list of words having the following beginnings and endings, and give the meanings in each case : *Per, contra, et, con, mis, ab, com ; -tion, -fy, -tude, -ive, -ble.*

Third Year.
(1) Paraphrase (*a*) lines 453-463—
So dear to Heaven . . . .
Till all be made immortal.
(*b*) Lines 463-475—
But when lust
. . . . degraded state.
(*c*) Lines 530-539—
This have I learnt
. . . . unweeting by the way.
(2) Analyse the same passages.
(3) Parse : (*a*) Till all be made immortal.
(*b*) As loth to leave the body that it loved.
(*c*) Methought so too.
(4) Classify the Pronouns and give examples.

4. Draw a memory map of the East Coast of England.

5. What are the chief industries of Ireland? Where are they carried on? Give some account of one of them.

6. Give a brief account of the education of England.

7. What do you know of The Bridal of Norwich, Salisbury Decree, New Forest, Doomsday Book, Curfew?

8. What were Feudal Incidents? Explain *Aids, Reliefs, Escheat, Primer Seisin.*

9. (*Second Year.*) What is the use of Mental Arithmetic. Explain fully.

10. (*Third Year.*) Write out notes of a lesson on Earthquakes.

11. (*Third Year.*) Give a list of the maps, pictures, diagrams, and apparatus which you think ought to be provided in a well-furnished schoolroom.

12. (*First Year.*) Name the intervals *doh—lah, me—te, fah—me*^{1}, *ray—fah, soh—doh.*

Second Year.—When **g** becomes **d** what is the distinguishing note of the new key? If the first note of the following passage be taken as *me*, what will the others become?

t l fe s l n fe s d' t

SCHOLARSHIP COURSE FOR DECEMBER 1897.

11TH MONTH—NOVEMBER 1897.

1. *Writing.*—Ten minutes' practice each day from a good novel. Every care must be taken with the exercise.

2. *Spelling.*—50 words per week from 'Words Commonly Misspelt,' or any good test. Test by dictation.

3. *Composition.*—Write one or two essays each week, selecting from :—
(*a*) The responsibilities of wealth.
(*b*) The moral advantages of manly English games.
(*c*) The sea and its wonders.
(*d*) A summer holiday.
(*e*) An Australian squatter's home and surroundings.
(*f*) The Historical novel.
(*g*) The influence of the electric telegraph on social life.

4. *English.*
(1) 25 roots and meanings per week.
(2) Revise all prefixes, affixes, rules for distinguishing Anglo-Saxon words.
(3) *Literature.*—Finish Meiklejohn's 'English Literature,' and revise up to 1485. Note especially the changes produced by the Norman Conquest.
(4) Make quite sure of all definitions of terms used in Grammar.

5. *Arithmetic.*—General problems. Revise all theory work.
Girls.—Algebra. Revise theory, and continue practice of Problems leading to Simple Equations.

6. *Algebra.*—Revise all proofs and work any test papers.
Mensuration.—Make quite sure of all formulæ and their proofs.

7. *Geography.*—Revise Notes on India, and African possessions. General revision of Asia.

8. *Euclid.*—Book I. Revise Props. 27-48. Four deductions per week.

9. *History.*—George III. to 1800. Chief points :—
(1) Close of Seven Years' War.
(2) American War of Independence.
(3) French Revolution and its effects.

10. *Teaching.*—'Scholarship School Management,' Chap. XI. Read up answers to Test questions.

11. *Domestic Economy.*—Revise Thrift and Investments.

12. *Music.*—Finish 'School Music Teacher.'

13. *French.*—Revise first half of 'La Grammaire.'

TEST QUESTIONS.

Work the following Test Examination :—

(Papers will be fully marked and criticised if sent to MR. A. T. Flux, The Bays, Belvedere, Kent, with a fee of 3s. 6d.)

Theory of Teaching.

(*Time* 2 *hours.*)

(Answer Question 1, and *six* others only.)

1. Make out notes of a lesson on one of the following subjects:—(*a*) The 'Union Jack'; (*b*) tin; (*c*) leaves of trees; (*d*) the foot-rule; (*e*) a railway station; (*d* and *e* to be for infants).

2. Describe any means by which thrift may be encouraged among the children of your class.

3. What are the advantages of training children to answer in sentences instead of single words?

4. Give some simple rules showing the best way of conducting a class lesson in writing.

5. What are the advantages of having the various changes of lessons in school executed by means of drill? Describe a good desk drill.

6. Give a sketch of a word-building lesson to Standard IV. Mention one or two principles which would guide you in giving the lesson.

7. What variety of occupations have you found suitable for children between 5 and 6 years old?

8. Mention some of the exterior circumstances which affect a child's mental ability.

9. Describe any means by which you would endeavour to secure the active co-operation of the parents of the children.

10. Discuss as fully as you can the educational value of object-lessons, (*a*) for infants, (*b*) for older scholars.

Composition.

(*Time* 1½ *hours.*)

Write an essay on one of the following topics:—

(*a*) The effects of the Jubilee on and in our Colonies.
(*b*) The reasoning power in animals.
(*c*) Gold-fields.

Penmanship.

(*Time* 10 *minutes.*)

Write as specimens of Penmanship:—

(*a*) Largehand—Aberdeenshire.
(*b*) Smallhand—Like a rose bloomed the lady and blithe as a bride.

History.

(*Time* 1½ *hours.*)

(Candidates may not answer more than FOUR Questions.)

1. What were the chief administrative reforms introduced by the Angevin Kings?

2. Trace the growth of Parliament in the Thirteenth Century. Describe the constitution of Parliament in 1295.

3. Give a description of any *two* of the following battles:—*Hastings, Bannockburn, Blenheim, Plassey.*

4. What historical events are connected with the following places? Give dates where you can:—*Château-Gaillard, Troyes, Barnet, Fotheringay Castle, Rochelle.*

5. Give a short account of *The Statute of Labourers, The Act of Supremacy, The Petition of Right.*

6. Give some account of the reduction of Ireland in William III.'s reign.

7. What were the difficulties which William III. had to face on ascending the throne? How were they overcome?

8. Trace briefly some of the chief results arising from the Revolution of 1688.

9. Write five or six lines about four of the following:—

(*a*) Government by ministry or cabinet.
(*b*) Darien scheme.
(*c*) National debt.
(*d*) Whigs and Tories.
(*e*) The Star Chamber.
(*f*) 'Passive Obedience.'
(*g*) South Sea Bubble.

Geography.

(*Time* 2 *hours.*)

(Answer the *first* question, and *five* others only.)

(Question 1 must not be omitted.)

1. Draw on the first page of your book a large and clear map of one of the following. Show two lines of latitude and two of longitude. Show and name important towns and noteworthy physical features:—

(*a*) The Basin of the Shannon, *or* the Yorkshire Ouse.
(*b*) Cape Colony.

2. Describe a coasting voyage round New Zealand.

3. Describe as accurately as you can the situation and natural surroundings of the following towns:—*Vancouver City, Calgary, Regina, Winnipeg, Quebec, St. John's* (Newfoundland).

4. Say where each of the following is and give some information about each:—*Rikn, Barbadoes, Bishop Auckland, Klondike, Fujiyama, Havana, Hokitika, Samoa, Yosemite Valley.*

5. What manufactures and exports of India have lately developed most? What are the chief reasons for the development?

6. State as accurately as you can the boundaries of Cape Colony proper, and compare the colony (1) in size, (2) in climate, (3) in population with Great Britain.

7. Describe, as to a senior class, a holiday trip in Ceylon *or* write a letter describing the impressions of an Englishman on first visiting Jamaica.

8. Write something (about a page if you can) about one of the following:—*Florida, Greenland, Korea, Paraguay, Tasmania, The Zambesi.*

9. Explain as concisely as you can how India is governed.

10. What is meant by 'Dominion of Canada.' Trace its growth, and mention its chief industries.

Algebra.

(*Time* 1½ *hours.*)

(You may answer *five* questions in Algebra, and *one* in Mensuration.)

Algebra.

1. (*a*) If $a^2 - bc = x$, $b^2 - ac = y$, $c^2 - ab = z$, prove that $ax + by + cz = (x + y + z)(a + b + c)$.

(*b*) Resolve into factors, $x^3 + x - 156$ and $64x^3 - 343y^3$.

2. Prove that the L.C.M. of any two algebraic expressions is found by dividing one of the expressions by their G.C.M., and multiplying the quotient by the other expression.

Find the G.C.M. of $91(x^3y - 3x^2y + 7xy - 21y)$ and $78(2x^4y^2 + 19x^2y^2 + 35y^2)$.

3. Simplify $\dfrac{x^3 + 2a^3}{x + a} - \dfrac{x^3 - 2a^3}{x - a} + 2ax$ and

$$\frac{x^4 - 8x^{\frac{1}{3}}y}{x^{\frac{2}{3}} + x\sqrt[3]{xy} + 4y^{\frac{2}{3}}}.$$

4. Solve the equations:—

(*a*) $\begin{cases} \dfrac{5x - 8y}{21} - \dfrac{3x - 2y}{28} = 1. \\ x - \dfrac{5x - 2y}{8} = 4. \end{cases}$

(*b*) $\dfrac{1}{3x - 6} + \dfrac{7x}{72(x + 2)} - \dfrac{5}{x^2 - 2} = 0.$

(*c*) $x^3 - 1 = 0.$

5. Prove that $(a^m)^n = a^{mn}$ when m and n are positive integers.

Find the sq. root of $1 - 4x$ to four terms.

6. A grocer gained as many shillings on the sale of some tea as there were pence in the cost price of a pound, or farthings in the retail price of two ounces. How many pounds did he sell?

Mensuration.

1. The sides of a triangle are 44 feet, 75 feet, 97 feet. (*a*) What fraction of an acre is its area? (*b*) What are the lengths of the three perpendiculars from its angles on the opposite sides?

2. Find the cost of making a path 7 feet wide round a circular ground, whose perimeter is 352 yards at 3s. 9d. per square yard.

$$\left(\pi = \frac{22}{7}\right).$$

Euclid.

(*Time* 1½ *hours.*)

(Capital letters (excluding A to F), not numbers to be used.)

(Answer *five* Questions only.)

1. Define *plane superficies, plane angle, semicircle, gnomon, and parallel straight lines.*

If a triangle PQR be turned over about its side PQ, show by Prop. 4, Book I. that the line joining the two positions of R is perpendicular to PQ.

2. To draw a straight line perpendicular to a given straight line of an unlimited length, from a given point without it.

From a given point draw a straight line, making equal angles with two given straight lines.

3. All the exterior angles of any rectilineal figure, made by producing the sides successively in the same direction, are together equal to 4 right angles.

PQR is an equilateral triangle, H, K are points in QR, PR such that QH = RK; QK, PH intersect at S. Show that the angle PSQ is equal to the sum of two angles of the equilateral triangle.

4. Equal triangles upon the same base and upon the same side of it are between the same parallels.

Bisect a given triangle by straight line drawn from a given point in one of its sides (I. 37, 38).

5. Show that Propositions 2 and 3 of the Second Book are special cases of Prop. 1. What are the corresponding algebraical formulae of these three?

6. In PR, a diagonal of the square PQRS a point T is taken. Show that the triangle whose sides are equal to PT, TR and the diagonal of a square described on QT will be right angled.

7. In every right-angled triangle, the square which is described on the side subtending the right angle is equal to the squares described on the sides which contain the right angle.

8. A rectangle has its long sides double the length of its short sides: describe a square equal in area without using a circle in the construction.

English Language and Literature.

(*Time* 2 *hours.*)

(All candidates *must* answer Question 1, and may select five, and *five* only of the rest.

No abbreviation of less than three letters is to be used in Parsing or Analysis.)

1. Analyse the following, and parse the words underlined :—

He is the freeman whom the truth makes *free*,
And all are slaves *beside*. There's not a chain
That hellish foes confederate for his harm
Can wind about him, *but* he casts it off
With as much ease as Samson his green withes.
He looks abroad into the varied field
Of Nature, and though *poor, perhaps, compared*
With those whose mansions glitter in his sight,
Calls the delightful scenery *all his own*.

2. Show the force of the Latin prefixes, *de-, re-, con-, pro-, ob-, e(ex-), ab*, by reference to English words derived from the compounds of *facio, factum* I throw ; *a* composition, *-ficio, -fectum*).

3. Explain and derive the terms :—Analysis, literature, vocabulary, grammar, *final*, mood, interjection, reciprocal.

4. How would you vary the lessons in English for Standard II. so as to avoid monotony ?

5. Explain, as to Standard VI., the meaning of 'Noun sentence,' and write *four* short passages, each containing one.

6. Comment on the following words, and give, where you can, examples of words similarly formed :—*A foot, yclept, twain, chode, kine, gotten, prithee, wot, hindmost.*

7. Sketch briefly the plot of any play of Shakespeare's not directly connected with English History, or that of one of Scott's novels.

8. Into what periods would you divide the English language ? Give reasons for your answer.

9. Who were the writers of the following works ? Say approximately when they lived, and write a short account of *one* of them :—
'Hudibras,' 'The Leviathan,' 'Gulliver's Travels,' 'The Earthly Paradise,' 'In Memoriam,' 'Lycidas,' 'Childe Harold's Pilgrimage,' 'Utopia,' 'Adam Bede,' 'Esmond,' 'Novum Organum.'

10. Write 15 or 20 lines about one of the following :—
(*a*) The rise of the newspaper.
(*b*) The Renaissance—its effects upon Literature.
(*c*) The Lake Poets.
(*d*) Anglo Saxon Literature.
(*e*) The effects of the Norman Conquest on the language.

NEEDLEWORK.

(*Time* 2 *hours.*)

(The exercises in one Section only to be worked.)

SECTION A.

Cut out in paper, and make up by tacking, a chemise suitable for a girl of eight (inch scale).

and

Gather six inches of calico into a band of three inches ; work a buttonhole on the band.

SECTION B.

Cut out in paper, and make up by tacking, a woman's gored flannel petticoat (quarter size).

and

Make up a piece of calico as a round or shaped band, set on a button, and make a buttonhole.

Marks will be given for industry and finish.

ARITHMETIC AND ELEMENTARY ALGEBRA.

(*Time* 3 *hours.*)

(Candidates must answer *three* only of the Questions under Section I., to which the highest marks are assigned, and may answer *ten* other questions. More marks are assigned to the Questions in Section III. than to those in Section II.
The solutions must be given at such a length as to be intelligible.)

SECTION I.

1. Divide 9,173 by 39, and show in the course of the working, as to a class of young children, how to find—
(*a*) The remainder after 39 has been subtracted from the dividend 200 times.
(*b*) How many times 39 has been subtracted when the remainder is 203.
(*c*) The product of 235 and 39.

2. Explain the terms :—Average, measure, quotient, stock, percentage, present worth.

3. Show, as to a class of children beginning Fractions, how to subtract $\frac{1}{3}$ from $\frac{1}{2}$, explaining each step clearly.

4. Give notes of a first lesson in Decimal Fractions.

SECTION II.

5. Divide £22 9s. 2d. among three persons, so that one has twice as much as the second, and three times as much as the third.

6. Find, by practice, the weight of 4,728 silver candlesticks, each weighing 2 lbs. 8 ozs. 10 dwt. 19 grs.

7. Make out the following bill, showing how the working may, in any case, be abbreviated :—

17½	lbs.	of mutton at	9½d.	per lb.
5¼	,,	,,	11d.	,,
13	,,	beef	,, 10¾d.	,,
7	,,	,,	,, 11½d.	,,
19	,,	bacon	,, 7¼d.	,,

What would be left out of a £5 note after paying the above, discount of 1od. in the £ being allowed ?

8. Simplify—

$$\frac{1+\frac{2}{3}-\frac{3}{4}}{1+\frac{2}{3}-\frac{1}{3}} \times \frac{1}{1+\frac{1}{2+\frac{1}{2}}} \times \left(1+\frac{1}{1+\frac{1}{10}}\right).$$

9. Divide $\frac{\cdot052}{1\cdot3}$ of 1·56 by $\frac{\cdot0624}{14\cdot4}$ of 25·92.

10. A man spends 4 per cent. of his money, and then 5 per cent. of what remains. What percentage of his money is left ?

11. At what rate of interest will the present worth of £100 10s. 3d., payable two years hence, be £93 10s. ?

12. Find the G.C.M. of 157 days 7 hours 4 minutes 7 seconds and 243 days 2 hours 11 minutes 49 seconds.

SECTION III.

13. Arrange in order of magnitude (3·909 + ·0909), (·001$\dot{3}$ × 3000), (·011974 ÷ ·003), and find the difference between greatest and least.

14. If 27 men, working 10 hours a day, can in 13 days build a wall ·39 metres thick, 1·98 metres high, and 318·65 metres long ; in how many days will 26 men, working 9 hours a day, build a wall ·26 metres thick, 1·87 metres high, and 573·57 metres long ?

15. The sum of £26 was divided amongst four men, A, B, C, D, in the following manner :—B's share was three times A's, C's was three times B's, D's was as much as A's, B's, and C's together ; what was the share of each ?

16. Find the simple interest and amount of £10,100 10s. for 4½ years at 9½ per cent. per annum.

17. A grocer sold 1 lb. of tea, and 3 lbs. of sugar for 6s., but if the tea rose 10 per cent. and the sugar 50 per cent., they would have cost 7s. What was the price per lb. of each ?

18. Bar iron which cost in making £41 13s. 4d. per ton is sold at a loss of 5⅔ per cent., what does it fetch per cwt. ?

19. A person sells out £4,800 in the 3 per cent. consols at 93, and invests the proceeds in New Zealand 6 per cent. stock at 108. Find the alteration in his income.

ALTERNATIVE QUESTIONS IN ALGEBRA.

(*Girls only.*)

(Any of these Questions may be answered instead of the same number of Questions in Sections II. and III., Arithmetic.
They will be more highly marked than the Questions in Arithmetic.)

1. Explain the terms :—*Factor, index, binomial, literal coefficient, numerical coefficient*, and describe the use of brackets.

2. Prove that $a-(b-c)=a-b+c$.

3. Find the value of—

$$\frac{a^2+b^2-c^2+2ab}{a^2-b^2-c^2-2bc}$$

when $a=4$, $b=-\frac{1}{2}$, $c=1$, and simplify—

$$p-[5q-\{p-(3r-3q)+2r-(p-2q-r)\}].$$

4. Divide $1-6x^5+5x^6$ by $1+2x+x^2$.

5. Solve the equations—
(1) $5(5x-6)-4(4x-5)+3(3x-2)-2x-16=0$.
(2) $\frac{3x}{4}+\frac{7x}{15}+\frac{11x}{6}=366$.
(3) $\frac{1}{2}(x-a)-\frac{1}{3}(2x-3b)-\frac{1}{4}(a-x)=10a+11b$.

6. A person who bought four houses, gave for the second half as much again as for the first, for the third half as much again as for the second, and for the fourth as much as for the first and third together. If he paid £800 for them all, what was the cost of each ?

MUSIC (TONIC SOL-FA).

(*Time* 40 *minutes.*)

(You are not to answer more than *five* Questions.)

1. Write the following in four-pulse measure. The figures show duration in pulses or fractions of a pulse. Begin on a strong pulse.

1	½	½	1½	½	½	½	½	½	1	½	½	1	¼	¼	¼	¼	1½	½	4
m	r	REST	s	m	r	l,	t,	f	f	m	REST	l	s	f	m	r	s	t,	d

2. Name the following intervals :—

m—r'	r—t	m—d'	d—fe
s—le	m—se	d—ma	r—fe

3. Re-write the following passages, making a change by bridge notes at (*a*), and a return to the original key at (*b*) :—

(i)

			(*a*)										(*b*)				
m	s	f	l	m	fe	l	s	d'	m	l	fe	r	s	d	m	f	r	d

(ii)

			(*a*)										(*b*)				
m	s	d'	s	l	ta	l	m'	r'	ta	s	m	f	l	s	d,	t	r'	d'

4. Write the minor scale in its three forms.

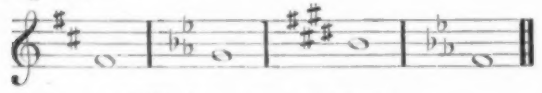
5. Which of the following notes is highest in pitch, and which lowest?— f^1 in Key C, r in Key A, m_1 in Key B♭, t in Key G, s in Key F, f_1 in Key E♭.

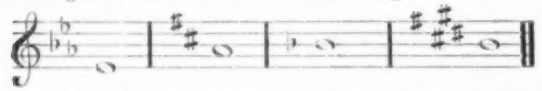
6. Explain (briefly) the following terms:—Rallentando, Poco Mosso, Meno Mosso, Leggiero, Maestoso, Allegretto.

Music (Staff Notation).

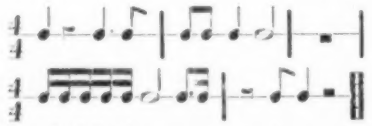
(*Time* 40 *minutes.*)

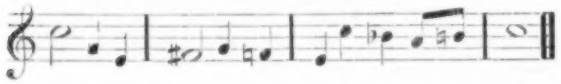
(Answer *five* Questions only.)

1. Write an imperfect or diminished fifth above each of the following notes:—

and an augmented fifth above each of the following:—



2. Write the signatures of the following minor keys:—G♯ minor, B minor, C minor, B♭ minor, F♯ minor.

3. Re-write the following in $\frac{4}{2}$ time, doubling the value of every note and rest, and again in $\frac{4}{8}$ time, halving the value of every note:—

4. Transpose the following passage a major second lower, viz., into the key of B♭. Add the new signature:—



5. Write the signature, the ascending and descending scale of G minor, using the minor seventh and the major sixth.

6. Explain the meaning of the following terms:—Pianissimo, Da Capo, Dolce, A tempo, Rallentando, Staccato.

Domestic Economy.

(*Time* 2 *hours.*)

(Candidates may answer *one* question in each Section.)

Section I.

1. What injuries to the human body may follow from taking an excessive amount of food?

2. Classify food-stuffs in accordance with their use and chemical nature.

Section II.

3. State briefly the chief reasons for cooking our food.

4. Write a set of notes, as for a lesson to an advanced class of girls, on the different ways in which meat may be cooked.

Section III.

5. Describe some common customs with regard to women's and children's attire, which are contrary to the fundamental laws of health.

6. To what points would you pay special heed in the selection, purchase, and maintenance of boots?

7. Give some simple rules for the preparation and use of starch for laundry purposes.

Section IV.

8. How would you provide for a regular and uninterrupted supply of fresh air in an ordinary bedroom? Why does a lofty ceiling not always ensure due ventilation?

9. Show the construction, use, and dangers of a 'Geyser' for heating a bath.

10. How is a sitting-room best dusted?

11. Compare the use of hot-water pipes for housewarming with that of open fire-grates, in respect of cost and efficiency.

Section V.

12. How and when is the clinical thermometer used in a sick room?

13. What qualifications are desirable in a professional nurse?

Section VI.

14. Write notes of a lesson on 'Co-operative Stores.'

15. In what way may a school penny bank be best founded and conducted?

RULES AS USUAL.

ANSWERS TO CORRESPONDENTS.

Pansy.—Penmanship, 56/60.

Gwynwydd.—Essay (1), 50/60. (2) 60/60. General writing good, but two many erasures.

W.A.F.—Essay, 52/60. Penmanship, 55/60.

Godwin.—Penmanship, 40/60. Irregular size in small hand; lack of grace and freedom. Notes of Lesson, 50/60. Parsing and analysis, 25/30. Paraphrase, 18/20. General style of work capable of great improvement.

Junction.—*Brun*, noun, obj. gov. by '*by*'; *hail*, interjection or verb in imperative mood; *goddess*, nominative of address; *wearied*, participle qual. *me*; *out*, adv. of manner mod. *wearied*; *else*, conjunction; *thou*, pronoun demonstrative nom. of address; *unassailed*, adj. qual. *life* and *honour*; *why*, interrogative adverb; *perhaps*, adv. of doubt; *beside*, prep. gov. *need*; *no*, adverb. of negation limiting *less*; *less*, adv. of degree limiting *imports* (understood).

Cornubian.—Writing 55/60. Revise by means of questions given.

F.J.H.—Essay 60/60. Paraphrasing 55/60.

$$\sqrt{2x+8}+2\sqrt{x+5}=2$$
$$=\sqrt{2x+8}=2-2\sqrt{x+5}.$$
Squaring $=2x+8=4-8\sqrt{x+5}+4(x+5)$
$$=2x+8=4-8\sqrt{x+5}+4x+20$$
$$=2x+8-4-4x-20=-8\sqrt{x+5}$$
$$=-2x-16=-8\sqrt{x+5}$$
$$=x+8=4\sqrt{x+5}.$$
Squaring $=x^2+16x+64=16x+80.$
$$x^2=16.$$
$$x=\pm 4.$$ Ans.

Other Correspondents by Post.

OUR 1898 CERTIFICATE CLASS.

BY J. C. HOROBIN, M.A.,
Principal, Cavendish College, Cambridge.

The Examination for Certificates will commence on Monday, 11th July 1898, at 2 p.m.

The general conditions for candidates are to be found in Articles 55–64 and 116–121 of the current Code.

Questions for Tests.

First Year.

Penmanship.

1. Write in Largehand the words '*Alphabetically brought.*'
" Smallhand " '*A quick brown fox jumps over a lazy dog.*'

Spelling.

2. Write from dictation:—

We must not confound the reforming legislator | with the jurist and parliamentary draughtsman. | It is not inventiveness | or originality | or technical skill | that we honour in those who presided over the transitions of States; | it is chiefly the massive courage | that moves free under responsibility. | On these principles | we estimate the rapid action of this enlightened statesman | as an essential element of the reform itself. | His promptitude | was perhaps rather instinctive than calculated | although he must have realised the necessity of justifying, | without delay, | the exaggerated expectations | that were entertained about him.

School Management.

1. What are the specific uses of drill in schools as an aid to discipline? Upon what points do young teachers especially need to be warned?

2. Write a short essay upon *School Museums*. How far should they be a collection of objects, and how far illustrations of series of lessons on particular subjects?

3. What are the underlying principles of Gifts I.–IV., and what subjects in the later school work have a useful foundation laid in Gifts I. and III.?

4. Discuss the various methods of teaching Subtraction.

Composition.

Write an essay upon 'Might is right.'

and

Write a letter to a friend whom you believe to be living beyond his means. Write also his reply.

Arithmetic.

Solutions to October Examples.

3. Reduce the given lengths to a common unit, viz., inches.
Then 6 yds. 5 ins. = 221 ins.,
6 yds. 2 ft. 7 ins. = 247 ins.,
and 8 yds. 2 ft. 11 ins. = 323 ins.
L.C.M. of 221, 247, and 323.

4. $\frac{\frac{3}{4}+\frac{1}{8}}{\frac{5}{6}+\frac{1}{8}}=\frac{\frac{6}{8}+\frac{1}{8}}{\frac{5}{6}+\frac{1}{8}}=\frac{\frac{7}{8}}{\frac{5}{6}}$

$$=\frac{5}{6}\div\frac{7}{8}=\frac{5}{\cancel{6}_{3}}\times\frac{\overset{4}{\cancel{8}}}{7}=\frac{20}{21}.$$

5. $\frac{3}{5}$ of 4s. $10\frac{1}{2}$d. $=\frac{3}{5}$ of $\frac{117}{2}$d. $=\frac{3\times117}{5\times2}$d. $=\frac{351}{10}$d.

Also £1 6s. = 312d.

Now 1d. = $\frac{1}{312}$ of £1 6s.

$\therefore \frac{351}{10}$d. $=\frac{351}{10}\times\frac{1}{312}$ of £1 6s. $=$ £$\frac{351}{3120}$.

Hence the fraction required $=\frac{351}{3120}=\frac{9}{80}$.

N.B.—In examination the solution may be stated thus:—

$$\text{Required fraction}=\frac{\frac{3}{5}\text{ of 4s. }10\frac{1}{2}\text{d.}}{\text{£1 6s.}}$$

$$=\frac{\frac{3}{5}\times\frac{117}{2}}{312}$$

$$=\frac{3}{5}\times\frac{117}{2}\times\frac{1}{312}=\frac{9}{80}.$$

6. Money spent on first occasion $=\frac{2}{3}$.
$\therefore$,, left ,, ,, ,, $=1-\frac{2}{3}=\frac{1}{3}$.
,, spent ,, second ,, $=\frac{1}{3}$ of $\frac{1}{3}=\frac{1}{9}$.
$\therefore$,, left ,, ,, ,, $=\frac{1}{3}-\frac{1}{9}=\frac{2}{9}$.
,, spent ,, third ,, $=\frac{1}{2}$ of $\frac{2}{9}=\frac{1}{9}$.
,, left ,, ,, ,, $=\frac{2}{9}-\frac{1}{9}=\frac{7}{9}$.
But by question, $\frac{7}{36}$ of the money = £7.
$\therefore \frac{1}{36}$,, ,, = £1.
$\therefore$ Original sum = £36.

7. Time taken to travel 10 miles = 1·5 hour.

,, ,, 1 mile $=\frac{1\cdot5}{10}$ hour.

,, ,, 4 miles $=\frac{1\cdot5\times4}{10}$ hour

$=$ ·6 hour.

8. Since £$3\frac{1}{2}$ income is obtained from £85 cash.

$\therefore$ £1 ,, ,, $\frac{£85}{3\frac{1}{2}}$ cash.

$\therefore$ £140 ,, ,, $\frac{£85\times140}{3\frac{1}{2}}$ cash.

$\therefore$ Amount required $=\frac{£85\times140}{3\frac{1}{2}}=$ £3,400.

9. From Monday, 1 p.m., to the following Friday, 5.15 p.m., is $100\frac{1}{4}$ hours.
In 1 hour the watch loses $\frac{7}{12}$ minute.
$\therefore$ In $100\frac{1}{4}$ hours the watch loses $(\frac{7}{12}\times100\frac{1}{4})$ min., *i.e.*, 58 min. $28\frac{1}{3}$ sec.
Time indicated = 5 hrs. 15 min. — 58 min. $28\frac{1}{3}$ sec.
= 16 min. $31\frac{2}{3}$ sec. past 4.

10. Let $a=$ ·02797979. (1)
Then $100a=$ 2·797979. (2)
and $10000a=279{\cdot}797979$. (3)
Subtracting the second line from the third—

$$9900a=277.$$
$$\therefore a=\tfrac{277}{9900}.$$

Note that in the second line we multiplied by that power of 10 which would move the decimal point just before the first figure of the circulating period, and in the third line by such a power of 10 as would move the decimal point just after the last figure of the period.

Hence, *a mixed circulating decimal is equivalent to a vulgar fraction whose numerator is the difference between the number formed by all the figures down to the first period, and the number formed by the figures which do not repeat; and whose denominator is formed of as many nines as there are repeating figures, followed by as many noughts as there are non-repeating figures in the decimal.*

NOVEMBER.

Arithmetic.

1. Explain with examples the method of equal additions as applied to Subtraction.
2. Explain carefully the reason of the rule for H. C. F.
3. Simplify $\dfrac{2\frac{19}{28}-\frac{5}{14}\text{ of }4\frac{6}{11}+3\frac{11}{12}\div7\frac{5}{8}}{3\frac{3}{11}\text{ of }10\frac{1}{2}-3\frac{1}{3}\div4\frac{2}{3}}$
4. Multiply ·0$\dot{6}$ by ·208$\dot{3}$.
5. Find the value of 44 acres 2 roods 25 perches at £55 16s. $7\frac{1}{2}$d. an acre.
6. What tax is paid on a house assessed at £107 10s., when the rate is 1s. 4d. in the pound?
7. If $\frac{5}{8}$ of a property be worth £1,200, what is the value of $\frac{4}{5}$ of it?
8. If 39 boys earn £117 in 8 weeks, how much will 26 boys earn in 19 weeks?
9. What rate per cent. is obtained by investing in a $3\frac{1}{2}$ per cent. stock at 85?
10. At what time between 6 and 7 o'clock will the hands of a watch be together?

Music.

1. State the names of the following intervals:—

l / d	f / t_1	s / r	r / t_1	s / f	m / d	r^1 / s	f / l_1

2. Re-arrange the following notes in order of pitch, placing the lowest note first in each case:—
(*a*) s^1, d, fe_1, l_1, t_1, d^1, s, ta, r, f_1, t, r, s, d
(*b*) d, s, r^1, f_1, fe, t_1, ta, m^1, l_1, s, d^1, r, f, t, d^1
3. What circumstances tend to modify the mental effects of scale tones?
4. What tones of the common major scale are (*a*) a minor third apart, and (*b*) a minor fourth apart?

English.

1. Write the singulars of *Kine, sheep, tenori, radii, series, data, dice, analyses, cherubim, hosen.*
2. Distinguish between *pease* and *peas*, *brothers* and *brethren*, *dies* and *dice*, *geniuses* and *genii.*
3. Analyse the following: Lines 13–18, page 13, 'Elia'; and parse: Must have leave, to regret, doing-away-with altogether, the red-letter days . . . dead-letter days.
4. What do you know of Trajan, Pliny, Alexander the Great? Comment upon Mattock, swol'n, obelisk, Dacian, Delectable Mountain, Pure Emanuel, crotchets, Parnassus, Sciential butteries.

Geography.

1. Give an account of France and of European Russia under the following heads:—
(*a*) Size and population.
(*b*) Form of government.
(*c*) Chief manufacturing towns and industries.
(*d*) Principal rivers and mountain ranges.
(*e*) Chief seaports and harbours.
2. Describe a journey from Paris to Buda-Pesth.
3. Trace (either by description or by means of a sketch-map) the course of these rivers: Tagus, Elbe, Volga.
4. State what you know about the following: Donegal, Adrianople, Valencia, Zealand, Messina, Bremen, Cherbourg, Belgrade, Kertch, Cannes, Morea, and Prague.

History.

1. Give short biographies of these personages:—Strafford, Pym, Blake, Shaftesbury, Monmouth.

2. For what events are the following dates memorable :—1604, 1605, 1637, 1644, 1645, 1658, 1678, and 'the 3rd of September'?

3. Give an account of the Barons' War.

4. Recount the circumstances connected with the Translation of the Bible into the Authorised Version.

Algebra.

1. Find the product of $a^{\frac{3}{2}} - ab^{\frac{1}{2}} + a^{\frac{1}{2}}b - b^{\frac{3}{2}}$ and $a + a^{\frac{1}{2}}b^{\frac{1}{2}} + b$, and divide $6x^5 + 13x^4 - 14x^3 - 17x^2 + 18x - 4$ by $3x^2 + 2x - 4$.

2. Resolve into elementary factors—

(1) $a^4 - b^4$. (2) $15x^2 + x - 84$; and prove that $(2a - b)^4 - (a - 2b)^4 = 15(a + b)(a - b)^3\left(1 + \frac{2ab}{5(a - b)^2}\right)$.

3. Solve the equations—

$$(1)\ \frac{a}{x - a} + \frac{b}{x - b} = \frac{a + b}{x - a - b}.$$

$$(2)\ \frac{1}{x^2 - 1} - \frac{1}{1 - x} = \frac{7}{8} - \frac{1}{x + 1}.$$

Geometry.

1. Define a plane rectilineal angle, a right angle, an obtuse angle, a triangle, an isosceles triangle, and distinguish between an axiom and a postulate.

From a given point to draw a straight line equal to a given straight line.

(Take the case where the given point is in the given straight line.)

2. Prove I. 11 without using I. 8.

3. If, at a point in a straight line, two other straight lines, on the opposite sides of it, make the adjacent angles together equal to two right angles, these two straight lines shall be in one and the same straight line.

PQR, PQS, RST, RSV are equilateral triangles. Show that TP, PQ, QV are in the same straight line.

4. Given the difference of two lines and the rectangle contained by them; find the lines.

SECOND YEAR.

School Management.

1. Describe in detail the process of marking, checking, and closing the daily registers. What exception is made to the rule for final closing? Sometimes, in marking registers, *a* is first entered and / is subsequently marked over it. Assuming that the child thus marked as 'present' reaches school before the time for closing the register, state a method for avoiding this irregularity.

2. What forms of mental activity are recognised, and on what does mental development depend?

3. Explain the fallacy in 'The events narrated by Homer are credible. Therefore Homer is a credible witness.'

Composition.

As First Year.

Music.

1. The tones *d r t_1 d* are the relative major for l_1 t_1 *se*, l_1 of the minor key. What tones in the relative major correspond to the following passage in the minor?

l_1 t_1 d m r f m t_1 r l_1 se_1 r d t_1 l_1

2. Write the following intervals :—

(*a*) Above *ray* an augmented (pluperfect) fourth or tritone; (*b*) Above te_1 a diminished seventh; (*c*) Above *doh* an augmented second.

3. The name for *ray* sharp is *re*. What do the following names show?

(*a*) *de*; (*b*) *la* (or *lau*); (*c*) *ra* (or *rau*); (*d*) *se*; (*e*) *ma* (or *mau*); (*f*) *ba* (or *bay* or *bah*).

4. Re-write the following on the imperfect method (*i.e.*, without change of key) :—

m s d r m ^{1}r t_1 d s_1 ^{1}m f r d t_1 d

English.

1. Wordsworth and Grammar as First Year.

Also write a summary of Act I., Scene 1, in 'M.N.D.,' and analyse 'Hamlet' Act I., Scene 5, lines 9-22, and parse the words—doom'd to fast, done, stars, be, blood.

2. Comment upon 'out of joint,' 'antic,' 'true-penny,' 'matin,' 'unhousel'd,' 'Hebenon,' 'inurn'd,' 'cerements,' 'clepe,' 'rede,' 'canker,' 'requite,' 'harbingers.'

Geography.

As First Year.

History.

1. As First Year.

Also write an account of George III.'s colonial policy, the causes which led to it and the results which followed from it.

2. What do you know of John Wilkes, and the steps which led to the publication of Parliamentary debates.

Algebra.

1. As First Year.

Also insert a number of geometric means between two given quantities.

If *a*, *b*, *c*, *d*, be in G. P., prove that $ax^2 + c$ divides $ax^3 + bx^2 + cx + d$.

2. Define Logarithm, Mantissa, Characteristic,

Prove $\log_a c = \log_a b \times \log_b c$.

3. Solve the equations :—

$$(a)\ \frac{8x - 15}{27} - \frac{5 - \frac{2x - 1}{7}}{18} - \frac{x - 30}{12} = \frac{1}{36}.$$

$$(b)\ \frac{1}{3x - 6} + \frac{7x}{72(x + 2)} - \frac{5}{x^2 - 4} = 0.$$

$$(c)\ x - y = 3,\ \frac{1}{x} + \frac{1}{y} = \frac{11}{3}\left(\frac{1}{y} - \frac{1}{x}\right).$$

Geometry.

1. As First Year.

2. Prove III. 16.

Draw a parallel to a given line to touch a given circle.

3. Prove III. 18.

If a quadrilateral be circumscribed to a circle, its diagonals intersect in the centre.

WOMEN ONLY.

Needlework.

First Year.

On given piece of calico (6 × 6) show not less than 3 inches of each of the following stitches :—hemming, sewing, stitching, and featherstitching.

Second Year.

Put in gusset as for the side of a boy's shirt, and cut out and tack together a wristband showing buttonholes and 3 inches of stitching.

Domestic Economy.

First Year.

1. Distinguish the different materials used for clothing, and write notes on the methods of cleaning the same.

2. Draw a diagram of the Respiratory system.

Second Year.

1. As First Year.

2. Explain as fully as you can what you mean by 'nutritive food,' and name six such foods in their order of value for (*a*) a person in good health, (*b*) a sick person.

OR

Geometry.

First Year.—1. Prove I. 4.

Define superficies, isosceles triangle, parallel line.

2. Prove I. 6.

If two lines be at right angles and each bisect the other, then any point in either is equally distant from the extremities of the other.

Second Year.—1. As First Year.

2. Prove I. 27.

Find a point in a given line that shall be equally distant from two given points.

SYLLABUS OF WORK FOR THE MONTH.

Students are advised not only to get up the work indicated, but to use the test questions also as indications of work to be got up and afterwards written out.

FIRST YEAR.

School Management.

1. School furniture, especially height, slope, and position drill in desks.

2. Place of Science (including object lessons) in the curriculum.
3. Discipline—aims—means.
4. English—order of procedure—composition.

Composition.

1. The licence with history which Shakespeare allows himself in Hamlet.
2. A crowd is not company.
3. A doubtful throne is ice on summer seas.
4. Order is power.

Arithmetic.

Not less than six examples from miscellaneous sets ought to be worked per week, as well as those on the particular work set and the examination questions given.

1. Pars. 112, 113*, 118 (note method), 119, P.
   Mensuration of triangle.
2. Pars. 128, 132, 136, 138 note, P.
   Same.
3. Pars. 146, 149, 152, P.
   Metric System.
4. Pars. 158, 162, 163.
   Same.

Music.

1. Division I., and suitable exercises thereon.
2. Division II., etc.
3. The special effects of *fah* and *lah*. Environment as a factor in mental effects.
4. Revise 1–3.

English.

1. History of personal pronouns.
2. Same of the interrogative and relative pronouns.
3. Varieties of Iambics with examples.
4. Revise case, number, and rules of punctuation.

Geography.

Macmillan's Geography of Europe by Sime will be found useful.

1. The lake systems of Europe.
2. Chronology of race movements.
3. Danube, Thames, Rhone (with sketch map).
4. Communication *with* Europe (steamers, etc.).

History.

1. Constitutions of Clarendon and the life of Becket.
2. War with France, 1793–1802, with lives of Bonaparte and Nelson.
3. The Great Charter and lives of Anselm and Roger Bacon.
4. Pitt, Wesley, the Pelhams, Young Pretender.

MEN ONLY.

Algebra.

1. Proof of rule for H.C.F. and L.C.M.
   Harmonic Progression.
2. Revise all definitions up to equations.
   Difference between an identity and equation.
   Harmonic Progression.
3. Simultaneous equations and methods of solution.
   Revise H.C.F.
   Geometric Progression.
2. Proof that a simple equation can only have one root.
   Geometric Progression.

Geometry.

1. Props. XIX.–XXI., Book I.
   ,, IX. Book II.
2. ,, XXIV.–XXVI., Book I.
   ,, X., Book II.
3. ,, XXIV.–XXVI., Book I.
   Revise I.–IV., Book II.
4. ,, XXVII.–XXXI., Book I.
   Revise V.–X., Book II.

N.B.—As many riders as possible should be worked.

WOMEN ONLY.

Needlework.

Practise all stitches for infant's shirt.
Diagrams for the same.

Domestic Economy.

Par. 107–119, Nelson's 'Domestic Economy.'
Sources and Materials of Clothing, or
1. Euclid Props. 5–10, Book I., and Revise Definitions.

SECOND YEAR.

School Management.

1. Fitch, Lecture III. (To school diaries.)
   Summary Register.
   Gifts 1–6 and their psychological basis.
   Chief ethical theories.
2. Remainder of Lecture III. (Fitch).
   Revise Attendance Register Rules.
   Object lessons, their *raison d'être* and suitability.
   Moral judgments.
3. Same as (1), Fitch.
   Log Book.
   Connotation and Denotation.
   Conciseness.
4. Same as (2), Fitch.
   Revise Summary Register.
   Logical character of terms.
   Sensation.

Composition.

As First Year.

Music.

1. Musical terms.
2. Leaning tones and the D, S, and F chords.
3. Musical terms.
4. Table of difficult intervals, and methods of practice to overcome.

English.

As First Year for Wordsworth and Grammar.
Hamlet :—
Act II. Sc. 1–2.
M.N.D. Act I. Sc. 2.

Arithmetic.
Geography. } As First Year.
History.

MEN ONLY.

Algebra.

As First Year.
Also 1. Compound Interest.
2. ,, ,,
3. Annuities.
4. ,,

Geometry.

As First Year.
Also 1. Book III. 20, 21.
Revise Definitions Book V.
2. Book III. 22.
,, VI. Definitions.
3. Book III. 23, 24.
,, VI. 1.
4. Book III. 26, 27.
,, VI. 2.

WOMEN ONLY.

Needlework.

Diagrams and stitches for muslin pinafore.

Domestic Economy.

As First Year.
Also Pars. 161–176.

TO STUDENTS.

I shall be glad to help students by examining for them specimen answers in each subject for the nominal fee of two shillings and sixpence per set, the postage being paid by the student both ways.

Students who wish to avail themselves of this will please answer the *first* question in each subject in the test questions given this month.—J.C.H.

OUR L.L.A. COURSE.

HONOURS EDUCATION.

BY THOS. CARTWRIGHT, B.A., B.SC. (LOND.)
Author of 'Mental Science and Logic for Teachers,' and of 'The L.L.A., What it is and How to Get it.'

THIRD PAPER.—SPENCER'S EDUCATION, CHAPS. III. AND IV.; LOCKE'S 'THOUGHTS.'

Digest.

CHAP. III., MORAL EDUCATION.—The main divisions of this chapter are three, being: **I. Introduction; II. Discipline of Consequences; III. Rules and Maxims.**

I. Introduction.—'To educate rightly is not a simple and easy thing, but a complex and extremely difficult thing, the hardest task that devolves on adult life.' 'It is sure to devolve on nine out of ten, yet there is **no preparation for it,** and consequently **the moral management of children is lamentably bad.**'

One means to improvement is **discussion.**

HEADS OF SPENCER'S DISCUSSION.—(1) Children are not born good, nor are they born bad. 'The popular idea that children are "innocent," while it is true with respect to evil *knowledge*, is totally false with respect to evil *impulses*.' (2) Parental unwisdom makes matters worse. 'We do not hesitate to blame parental misconduct for a great part of the domestic disorder commonly ascribed to the perversity of children,' so that 'difficulties of moral education are necessarily of dual origin—necessarily result from the combined faults of parents and children.' (3) Harsh discipline, finding expression in artificial punishments, is not the best discipline even for the 'greater harshness which children will meet on entering into the the world, for (4) the tendency should be towards an ideal standard, even if such be practically unattainable.

II. The Discipline of Consequences.—This is introduced by reference to the child's careless accident, and the accompanying pain which incites to greater care. Here 'misconduct and its consequences are reduced to their simplest forms,' for that which is wrong physically brings pain, and likewise that which is wrong morally has pain as its concomitant, and therefore to know how to avoid pain is to know how to avoid wrong actions, whether physical or moral. 'From whatever assumption they start, all theories of morality agree that conduct, whose total results, immediate and remote, are beneficial, is good conduct; while conduct whose total results, immediate and remote, are injurious, is bad conduct;' and, again, experiences of pain are 'beneficent checks to actions that are essentially at variance with bodily welfare.' Concerning these natural reactions, Spencer claims that they are (1) **proportionate to transgression;** (2) that they are **constant, direct, unhesitating,** and **not to be escaped;** (3) that they **'hold throughout adult life as well as throughout infantine life';** (4) **that they are in accordance with Nature,** and should, therefore, be allowed free play by parents. But are not 'the scoldings, the threats and blows,' natural reactions? In a sense yes. They *were* the natural reactions in a former age, when 'uncontrollable children' were trained by ill-controlled adults." They are now relics of a bad past, and certainly unsuitable to the better future, which will be begotten of better methods—'educational methods in use are apt to be considerably out of harmony with the times.' (5) **Parents as Nature's proxies,** exemplified in 'making a litter,' in tardily getting ready for a walk, in breaking the knife. (6) The advantages of natural reactions over artificial punishments are: (*a*) they connect sin and misery as **cause and effect;** (*b*) they are recognised as **just;** (*c*) they avoid the kindling of ill-feeling between child and parent; and (*d*) thus prevent estrangement. **More serious misconduct** is still to be dealt with by natural reactions, viz., the **displeasure of parents,** a punishment which will be all the more potent because of the larger sympathy likely to exist under the new *régime*. 'To simply warn him of danger, and to be ready to prevent any serious damage,' is the rule; hence 'in those occasional hazards where there is a risk of broken limbs or other serious injury, **forcible prevention is called for.** The greater sympathy will render grave offences less frequent, because of the greater reluctance to forfeit this valued esteem.' Thus 'gentleness begets gentleness.'

III. Rules and Maxims:—

(1) **Do not expect from a child any great amount of moral goodness;** but

(2) **Be content with moderate measures and moderate results.**

(3) **Avoid excess of control, and leave your child, wherever you can, to the discipline of experience.**

(4) **Do not, however, seek to behave as a passionless instrument, but supplement natural reactions by parental approbation and disapprobation.**

(5) **Beware of extremes in approbation or displeasure.**

(6) **Be sparing of commands; but whenever you do command, command with decision and consistency,** for of errors in education one of the worst is inconsistency. 'Avoid coercive measures whenever it is possible to do so; but when you find despotism really necessary, be despotic in good earnest. **Remember that the aims of your discipline should be to produce a self-governing being; not to produce a being to be governed by others.**'

(7) **Do not regret the display of considerable self-will on the part of your child.**

(8) **Always recollect that to educate rightly is not a simple and easy thing, but a complex and extremely difficult thing.** It is a truth yet remaining to be recognised, that the last stage in the mental development of each man and woman is to be reached only through a proper discharge of the parental duties.

Criticism.

Introduction.—'We cannot, of course, teach boys and girls at school how to discharge their duties as parents at the school age; such instruction could have no link of association with the knowledge and experience of the boy and girl, and would be wholly futile. We teach children there their future duties when they grow up to be men and women by being ourselves an example to them, which they will remember and imitate; nothing in education is so potent as tradition early received. But when Spencer suggests that the education of young men and women should culminate in the study of education—that is to say, of moral education—I think he gives utterance to a novel idea, which is not to be set hastily aside because of its novelty. Perhaps it will one day be accepted as a truism—at least, as regards young women.' (Prof. Laurie.)

Discipline of Consequences.—'Mr. Spencer's principle is excellent, but the **opportunities for applying it are far less frequent** than our philosopher believes. The **child,** in most cases, is **too little reflective,** too little reasonable, to comprehend, and especially to heed, the suggestions of personal interest.

Let us add that the principle is **wholly negative,** that it furnishes at most only the means of shunning evil; that even in according to it an efficacy it does not have, it would still be necessary to reproach it with narrowing moral culture by reducing it to the rather mean solicitude for simple utility; and, that it exercises no influence on the development of the positive virtues, on the disinterested education of morality in what is noble and exalted.

Finally, the system of natural punishments would incur the danger of often being **cruel,** and of causing the child an irreparable injury. Let pass the pin-cushion, the boiling water, and the candle flame, examples which Mr. Spencer proposes; but what shall we say of the bar of red-hot iron which he lets the child pick up? What shall be said, above all, of the grave consequences entailed by the faults of a young man left to himself?

'Would it not be,' says Gréard, 'justly to condemn the child to a *régime*, so severe as to be an injustice, to count solely on the effects of natural reactions and inevitable consequences, for the purpose of disciplining his will? The **penalty** which they provoke is the most often **enormous** as compared with the fault that has produced them, and man himself demands for his conduct other reactions than those of a harsh reality.' He desires that we **judge the intention as well as the fact;** that he be **commended for his efforts;** that **in the first instance extreme measures be not taken against him;** that the blow fall on him if needs be, but **without crushing him,** and while **extending a hand to help him up.**' (Prof. Compayre.)

It is further to be pointed out that natural reactions, except the secondary ones of parental approbation and the reverse, are merely physicial, and result not from the breach of a moral, but from the breach of a physical law. Their connection with morality is thus only accidental. This is well brought out by Prof. Laurie in the following extract:—'If I amuse myself by sticking a pin in my leg, I feel pain, and I seek some other amusement in the future. There is here a "natural reaction," that is to say, Nature instantaneously punishes an infraction of Nature's laws. Spencer's main proposition, then, as regards method of moral training, is, let the reaction of Nature take place. Now it is not morally wrong to stick a pin in my leg. It is a physical miscalculation. Mr. Spencer confounds moral and emotional with physical reactions. When a little boy in his anger smashes his mother's best china bowl, the natural reaction is a feeling of great satisfaction. When he burns his Catechism in the hope of so ending a painful series of daily lessons, the flames are less bright and joyous than those in his own heart. This is the natural reaction. Then, again, when he climbs a tree and falls and breaks his leg, the natural reaction of his being such a goose as to

loose hold of one footing before he has secured the next is manifest. He has broken a physical law, but not a moral law, and must take the physical consequences. If he has taken firm hold and secures the object of his ambition—the thrush's nest—and sells the eggs for sixpence apiece, he now enjoys the natural reaction as before he suffered from it. It is quite clear from this that natural reactions are outside the moral sphere altogether, and that, if there is anything immoral in his act, it must arise in some other way.' And later on he says, 'A good thing it is that *we* have to determine punishments and not Nature; for Nature is **blind** and **stupid** and often **cruel.** Spencer says that natural reactions are "pure justice." On the contrary, they very seldom see justice at all if **men** do not **guide and control** them. Natural reactions are constantly too slight for the offence, more frequently too grave.'

Digest.

CHAP. IV. PHYSICAL EDUCATION.—The heads of this chapter are: (i.) **Introduction,** (ii.) **Food,** (iii.) **Clothing,** (iv.) **Exercise,** (v.) **Mental Strain,** (vi.) **Conclusion.** Very little need be said either in exposition or in criticism thereof, because it is easy to understand and contains no burning controversial points.

(i.) **Introduction.**—The care of animals. The neglect of children. First a good animal.

(ii.) **Food:** (*a*) **quantity.**—Appetite is a trustworthy guide, for gluttony does not exist until restriction has engendered it. The taste for sweets and for fruits is a healthy one, as sugar is a food.

(*b*) **Quality.** Children have not only to supply the waste of tissue, but to **provide for growth,** hence their diet should be **more** and not less nutritive than that of adults. **Digestive power** should be **economised**; a vegetarian diet is wrong. That **energy depends on nutritive food** is apparent (1) from the fact that well-fed races are the dominant races; (2) from a comparison of the energetic horse with the lethargic cow; (3) from the study of the condition of the labourer.

A mixed diet essential, and a change of *menu* should be practised in order that sufficient food may be taken, since **dyspepsia is a result of low feeding.**

III. **Clothing. Not to be scanty,** since hardening means stunting, and clothing is an equivalent for food, and badly-clothed children must provide a double amount of heat from food—**nor delicate and unfit for rough usage,** for activity must not be curbed—should be **warm, woollen,** and **strong.** (Compare Locke here.)

IV. **Exercise** sufficient for boys, but sadly insufficient in the case of girls, although (1) **delicate women are not attractive,** (2) **there is no danger of making women boisterous** by encouraging exercise, (3) Gymnastics are not enough, because they have not the happy lively effect so conspicuous in play, and **happiness adds immense zest** to bodily functions.

V. **Mental strain** is shown by the **physical inferiority of modern men** as compared with their fathers, which inferiority is **due to mental strain,** since in all other respects the life of to-day is an improvement upon the drunken boisterous life of our fathers. The time table of a girl's boarding school and of a training college for men illustrates this view. **The anxiety shown respecting overstrain in childhood is just as necessary in the case of youth,** for Nature only permits undue activity in one direction **at the expense of growth and development** in another. **Growth is retarded, the brain is overworked, the health suffers,** and **children are physically ruined** by mental strain, which after all resolves itself into **cramming,** whereby (1) there is **no acquisition of knowledge**; (2) **study** is made **positively distasteful**; (3) thought is aborted, since there is no reflection but merely automatic retention; (4) **health is injured**; and (5) **the student is injured,** especially when a **woman,** who is thereby made the **reverse of attractive.**

VI. **Conclusion.** Education is too exclusively mental to the neglect of health, the preservation of which is an imperative duty not only for the individual but for posterity.

Criticism.

The only fault to find with this chapter is that it errs somewhat on the side of overstatement. It is certain that the man of to-day is a better animal than was his father, and the same applies to the daughter, who is in height and physique far superior to her mother. Still this is only a result of the wise measures recommended by Spencer.

Upon such a controversial point as vegetarianism we shall not enter. The most serious part of the chapter is that which attributes —and rightly so—physical evil to mental strain. Here again, since when Spencer penned his indictment, there has been a notable advance, especially as concerns women. But there is room for much further improvement.

QUESTIONS.

1. Write a brief summary of the chapter on Moral Education.
2. Explain and criticise the 'System of Discipline by Natural Reactions,' and show how far it is applicable in school.
3. State the substance of Mr. Spencer's views on the teaching of Geometry.
4. State and criticise Mr. Spencer's views on the cramming system.
5. In what order do the 'Faculties' unfold?
6. What are the main conditions of good health?
7. Criticise the chief positions in the summary of the chapter on 'Moral Education.'

LOCKE'S THOUGHTS.

(*a*) **The Life of Locke.** Thanks to the Rev. H. R. Quick—whose edition of the 'Thoughts' (published by the Cambridge University Press) we shall use in these notes—there will be no necessity for a digest. The student has this presented to him on pages 3 and 4 of Mr. Quick's book. A life of Locke will very probably indeed be asked for, and the student will, therefore, be well advised to get by heart the heads of Locke's life as told by Quick.

Some chief points are (1) **Locke's ill health.** This undoubtedly is to be credited with the famous **hardening process,** in the possibility and efficacy of which Locke so profoundly believed, but which we shall, later on, take occasion to criticise adversely.

(2) **His discomfort at Westminster and at Oxford.** This caused him to hold very strong views against public school and university life, and to prefer private tuition as the ideal means to a proper education.

(3) **His medical training, his devotion to philosophy,** and **his practical experience in teaching.** From this followed his attention to physical and moral as well as to intellectual education.

(4) **His perfect faith in reason as the guide to action, and his distrust of emotion.**

(5) **His utilitarianism,** which, however, as Quick shows, is not so pronounced as appears from the Thoughts, since 'the main thing to be considered in every action of the child is what influence it will have upon his mind.'

(*b*) **The Thoughts.** Here again there is no call for a digest, the want being supplied in the book used. The student should, after a careful perusal of the text, go back to contents in page 5 *et seq.*, and see if the heads there to be found call up the details given in the various sections.

In **physical education** the chief point of controversy is the **hardening process,** concerning which Compayré thus writes: 'It is certain that Locke treats children with an unheard severity, all the more surprising in the case of one who had an infirm and delicate constitution that could be kept in repair only through precaution and management. I do not know whether the consequences of the treatment which he proposes, applied to the letter, might not be disastrous. Madame de Sevigné was more nearly right when she wrote, "If your son is very robust, a rude education is good; but if he is delicate, I think that in your attempts to make him robust you would kill him." The body, says Locke, may be accustomed to everything. We may reply to this by quoting an anecdote of Peter the Great, who one day took it into his head, it is said, that it would be best for all the sailors to form the habit of drinking salt water. Immediately he promulgated an edict which ordered that all naval cadets should henceforth drink only sea-water. The boys all died, and there the experiment stopped. Still without subscribing to Locke's paradoxes, which have found no one to approve of them except Rousseau, we should recollect that in his precepts on physical education as a whole the author of the 'Thoughts' deserves our commendation for having recommended **a manly course of discipline,** and **a frugal diet,** for having discarded fashionable conventionalities and **drawn near to nature,** and for having **condemned the refinements of an indolent mode of life,** and for being **inspired by the simple and manly customs of England.**

It will be useful to compare Locke with Spencer in this matter of how to feed and exercise the body. Some striking disagreements as to detail cannot hide the fact that the philosopher of the nineteenth century is practically at one with him of the seventeenth in demanding attention to the proper training of the body as a means to the adequate training of the mind. In respect to cold water and its effects upon the body, the notes by Dr. J. F. Payne on page 207 should be read. The opinion of Locke was in the right direction, but it went too far. The cold matutinal bath is now a very common experience and of manifest efficacy, but the danger of damp feet is just as real as ever, so that the teacher's duty as to this certainly lies in an opposite direction to that recommended by Locke. In speaking strongly concerning the wisdom of instruction in swimming, Locke is in line with the best thought of to-day, when many think that the art of natation should rank with the art of drawing

as a compulsory subject, and certainly nought but good would ensue if such were indeed to be the case. We shall not agree with Locke in his remarks concerning sugar and fruit, but on this point the student must carefully read the notes which up to page 216 must be carefully pondered over. The student also will not wisely neglect to read with extreme care all that Quick has to say on the subject of Locke in his 'Reformers.' The summary given in section 30 brings to a conclusion all that Locke has to say on the subject of Physical Education. The rules given therein may well be committed to memory:—**Plenty of open air, exercise and sleep; plain diet, no wine or strong drink, and very little or no physic; not too warm and strait clothing.** The latter part, referring to the feet, should at least be translated into a recommendation for frequent cold baths, as above pointed out.

The sections already taken in Locke have again and again been set by the examiners, as will appear from the questions, and it is almost certain that the student will be asked either for a life of Locke, or for an account of his doctrine on Physical Education, so that there is every reason from an examinational standpoint to emphasise this part of the work.

Questions.

8. Write a short account of John Locke's life.
9. Write a summary of his views on the physical education of a child, and state in what points modern science has shown him to be wrong.
10. Write a summary of Locke's views on Physical Education.
11. State Locke's views on habit and habits, and criticise them.
12. State and criticise the main positions in Locke's theory of Physical Education.
13. Write a summary of Mr. Quick's criticism of Montaigne's educational ideas.

Questions Set in 1896 and in 1897.

These need not be answered now, but should be carefully read in order to see the trend of the most recent questions. They will constitute an excellent test immediately prior to the examination in June.

1896.

1. How does Herbert Spencer classify our activities?
2. State and criticise Spencer's views regarding the teaching of History.
3. In what ways does Science afford moral discipline?
4. Explain fully and illustrate by examples what Spencer means by 'the decline of mechanical methods' and 'the rise of new methods.'
5. Explain and illustrate the following:—
   (*a*) The method of nature is the archetype of all methods.
   (*b*) The youth instructed in principles solves a new case as readily as an old one.
   (*c*) A higher knowledge tends continually to limit our interference with the processes of life.
6. What is meant by 'Educational values?' Explain fully.
7. State the 'Laws of Mental Evolution.'
8. Give the substance of Spencer's attack on the cramming system, and show how much of it is true.

1897.

1. State and examine the fallacies in Mr. Spencer's estimate of what are called Educational Values.
2. What is the 'Science of Society'?
3. What guidance does psychology give to teachers?
4. State the main positions in the chapter on 'Intellectual Education,' and criticise them.
5. State fully what Spencer means by the Method of Nature.
6. Explain and illustrate the statement: 'Right methods produce interest.'
7. What is meant by making Education 'a process of self-evolution'? Explain fully and criticise.
8. Of what fallacies is Mr. Spencer guilty in his chapter on Moral Education?

OUR AMATEUR PHOTOGRAPHIC PRIZE COMPETITION.

(*See Pages* 236 *and* 237.)

In accordance with our promise of last month we now have the pleasure to present our readers with two pages of illustrations selected from some of the best work submitted in connection with this Competition. The reproductions, though necessarily much smaller than the originals, will serve to place on record in a permanent form the results of our second annual competition.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

C.H.F.—If $c_0, c_1, c_2, \ldots c_n$ denote the coefficients in the expansion of $(1+x)^n$, prove that

$$c_0 + \frac{c_1}{2} + \frac{c_2}{3} + \ldots \frac{c_n}{n+1} = \frac{2^{n+1}-1}{n+1},$$

(Hall and Knight's Algebra, p. 148.)

$$(1+x)^n = 1 + nx + \frac{n\cdot(n-1)}{1\cdot 2}x^2 + \frac{n\cdot(n-1)(n-2)}{1\cdot 2\cdot 3}x^3 + \ldots x^n$$

If we put $x = 1$, we get

$$2^n - 1 = n + \frac{n\cdot(n-1)}{1\cdot 2} + \frac{n\cdot(n-1)(n-2)}{1\cdot 2\cdot 3} + \ldots \quad (1)$$

Now $c_0 + \frac{c_1}{2} + \frac{c_2}{3} + \frac{c_3}{4} + \ldots \frac{c_n}{n+1}$ is the same as

$$1 + \frac{n}{1\cdot 2} + \frac{n\cdot(n-1)}{1\cdot 2\cdot 3} + \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3\cdot 4} + \ldots \frac{n(n-1)(n-2)\ldots 1}{1\cdot 2\cdot 3\ldots n(n+1)} \quad (2)$$

Now, if you examine any of these terms, say the 4th, you will observe that there is one factor less in the numerator than in the denominator; there is one short, as it were. Therefore, put one more factor in every numerator, and let this be $n+1$, so that (2) now reads (after dividing by $n+1$ as well)

$$\frac{1}{(n+1)}\left[n+1 + \frac{(n+1)n}{1\cdot 2} + \frac{(n+1)n(n-1)(n-2)}{1\cdot 2\cdot 3\cdot 4} + \ldots \frac{(n+1)n(n-1)\ldots 1}{1\cdot 2\cdot 3\cdot 4\ldots n\cdot(n+1)}\right.$$

But the part inside the bracket is just of the same *form* as the right hand of (1), and is therefore equal to $2^{n+1}-1$; hence the whole is $\frac{2^{n+1}-1}{n+1}$.

Xie.—A man buys an article and sells it again so as to gain 5%. If he had bought it at 5% less and sold it for 1s. less he would have gained 10%. Find the cost price. (Hamblin Smith's Exam. Papers, 735.)

Let x = the cost price in shillings; then he sells it at $x + \frac{1}{20}x$.

If he had bought at 5% less than x the cost price would have been $x - \frac{1}{20}x$, and if he had sold it at 1s. less he would have sold it at $x + \frac{1}{20}x - 1$. Now, this latter selling price is (according to the question) 10% more than the latter cost price, that is,

$$x + \tfrac{1}{20}x - 1 = \tfrac{11}{10}\left[x - \tfrac{1}{20}x\right]$$

$$20x + x - 20 = 22\left[x - \frac{x}{20}\right]$$

$$400x + 20x - 400 = 22(20x - x)$$

from which $x = 200$ shillings, or £10.

Moco.—At a paper chase the hares had 20 minutes start and ran the whole distance at the rate of 9 miles per hour. One of the hounds, who ran the same course at the rate of 10 miles per hour, arrived 8 minutes after the hares. How long was the run?

If the hounds start 20 minutes after the hares and one of them arrives 8 minutes after the hares, then it takes it 12 minutes, or $\frac{1}{5}$ of an hour less, than the hares to do the course.

But if x is the length of course in miles, $\frac{x}{9}$ is the time occupied by the hares, and $\frac{x}{10}$ is the time occupied by the hound,

hence $\frac{x}{10} = \frac{x}{9} - \frac{1}{5}$,

that is $9x = 10x - 18$,

or $x = 18$ miles.

A. Lindesay.—Sum to 10 terms, $2 + 2\frac{2}{3} + 3\frac{1}{3} + \ldots\ldots$

The common difference is $\frac{2}{3}$. The *third* term is equal to the first term + *twice* $\frac{2}{3}$; the *fourth* term is equal to the first term + *three* times the common difference, and so on. Hence the *tenth* term is equal to the first term + *nine* times the common difference; this will be $2 + 9 \times \frac{2}{3} = 8$

$$s = 2 + 2\tfrac{2}{3} + 3\tfrac{1}{3} + \ldots\ldots 7\tfrac{1}{3} + 8;$$
$$\text{also } s = 8 + 7\tfrac{1}{3} + 6\tfrac{2}{3} + \ldots\ldots 2\tfrac{2}{3} + 2$$
$$2s = 10 + 10 + 10 + \ldots\ldots 10 + 10 = 100$$
$$s = 50.$$

Kismet.—A is 4 years more than 3 times as old as B. If they live 10 years more A will be 45 years younger than 3 times B's age. Find their present ages.

The question, as stated, is an impossible one, but from your own attempt at a solution we think that A must be 4 years more than *twice* as old as B (not 3 times).

A's present age is twice B's, together with 4. In 10 years A's age will be 'twice B's present age together with 14.' Now B's age in ten years will be B's present age together with 10. So the question says that A's age in 10 years is three times (B's present age + 10) — 45, *i.e.*, 'three times B's present age + 30 — 45.' Hence the two statements within the inverted commas mean the same thing, and therefore 14 must be the same as B's present age — 15; hence B's present age must be 29.

We suppose that this would be considered as an arithmetical solution, but how utterly absurd it seems to have to write all this down instead of doing it algebraically, as you did yourself.

Yes, the answer to Q. 3, p. 153, September P.T. should be 59400.

E. J. Jones.—A shipowner insuring a vessel worth £1,250 at 3 per cent. lost £86 when the vessel was wrecked; for how much had he insured it?—(Cusack's Arithmetic, p. 537.)

The man pays down 3 per cent. of a certain sum of money; he afterwards has paid to him this sum of money; therefore, so far as these two transactions are concerned, he is 97 per cent. of this sum in hand. If by the vessel being wrecked he lost nothing, then this 97 per cent. of the sum would be equal to £1,250; but he loses £86, hence 97 per cent. of the sum insured for must be the same as £1,250 less £86, or £1,164. The required sum is therefore $\frac{100}{97}$ of £1,164, or £1,200.

Taivo.—A cistern has two feeding pipes, one of which can fill it in 5 minutes, and the other in 6 minutes: and also a relief pipe which can empty it in 8 minutes. Supposing the two feeding pipes to run a minute and a half before the relief pipe is opened, how long will it take to fill the cistern?

Each minute the first pipe supplies $\frac{1}{5}$, and the second pipe $\frac{1}{6}$ of the contents of the cistern, or $\frac{1}{5} + \frac{1}{6}$, *i.e.* $\frac{11}{30}$, together; hence in $1\frac{1}{2}$ minutes there is $\frac{3}{2} \times \frac{11}{30}$, or $\frac{11}{20}$ in the tank. The relief pipe being now opened it allows $\frac{1}{8}$ to run out each minute, and as $\frac{11}{30}$ are supplied each minute, the tank is being filled at the rate of $\frac{11}{30} - \frac{1}{8}$, or $\frac{29}{120}$ per minute. Therefore, since, at the moment the relief pipe is opened there only remains $\frac{9}{20}$ to be filled, it will take $\frac{9}{20} \div \frac{29}{120}$, or $1\frac{23}{29}$ minutes to do it. Reckoning from the time the feed pipes are open, the answer will be $1\frac{23}{29} + 1\frac{1}{2}$ or $3\frac{21}{58}$ minutes.

C. H. F.—Find the number of different ways of dividing *mn* things into *n* equal groups.—(Hall and Knight, p. 132.)

In order to make this clear we will take 6 things to be divided into 3 equal groups. Let the six things be denoted by A, B, C, D, E, F. There are two things in each group, so commence by selecting one group of *two* things. This can be done in

$$\frac{\lfloor 6}{\lfloor 2 \lfloor 4},$$

or 15 ways. Now take *any one* of these pairs, say A B, and place it on one side somewhere. (Remember that there are 15 ways of removing a pair in this way.) There are now 4 things left. Select another pair; this can be done in

$$\frac{\lfloor 4}{\lfloor 2 \lfloor 2},$$

or 6 ways. Take any one of these pairs, say C D (for C D must be one of the 6), and place it along with the pair A B. We have now used 4 letters and there is a single pair left, E F, since we have chosen AB, CD, already. This gives *one* way of dividing up the 6 things, and you will most probably think that the answer ought to be

$$\frac{\lfloor 6}{\lfloor 2 \lfloor 4} \times \frac{\lfloor 4}{\lfloor 2 \lfloor 2} \times 1 = \frac{\lfloor 6}{\{\lfloor 2\}^3} = 90.$$

But do you not see that CD might have been chosen first instead of AB, followed by AB, EF? This is surely included in the 90 obtained above; so also is CD, EF, AB, and there are $\lfloor 3$ ways, or orders, in which these pairs might have occurred. But they all count as the *same* way of dividing the 6 things into 3 pairs. The correct answer you will now readily see is

$$\frac{90}{\lfloor 3} \text{ or } \frac{\lfloor 6}{\{\lfloor 2\}^3 \lfloor 3},$$

and to your question it is therefore

$$\frac{\lfloor mn}{\{\lfloor m\}^n \lfloor n}.$$

Other Replies by Post.

SCIENCE NOTES.

Retamine, a New Alkaloid.—A new alkaloid—retamine—has been isolated by Battandier and Malosse from the young shoots and branches of *Retama sphaerocarpa*. It crystallises in long needles from petroleum ether, and in prismatic scales from alcohol. It melts at 162° C. with decomposition. It is a powerful base, and also a reducing agent and gives crystalline salts. It is only slightly soluble in ether and in water, but is dissolved not without alteration in chloroform.

***

The Function of Oil in Leaves.—From a series of observations which Herr Rywosch has recently made on the oil contained in the leaves of a number of plants, he concludes that its function is quite different from that of the oil contained in the woody stems of other plants. Instead of being stored up during the winter and disappearing in the spring, it remains and increases in amount during the spring and summer, and is found in large quantities even when the leaves have turned yellow in autumn. Instead of being a reserved food material, it appears designed to take up the xanthophyll.

***

Recent Experiments on Diastase.—An interesting series of experiments has recently been carried out by Professor Pfeffer with the view of ascertaining the conditions under which diastase is formed in plants. The plants which formed the subjects of these investigations were *Penicillium glaucum*, *Aspergillus niger*, and *Bacterium megaterium*. The production of diastase was found always to be decreased by an increase in the amount of sugar in the nutrient material, but the same result did not take place when instead of the sugar there was used some other carbohydrate, glycerine, or tartaric acid. In Professor Pfeffer's opinion the arrest in the production of diastase is not a purely chemical or physical phenomenon, but is the consequence of irritation exerted on the organism by a solution of sugar of a definite degree of concentration.

***

A New Local Anæsthetic.—The new anæsthetic, orthoform, has no toxic effects, while it is a powerful antiseptic and well adapted for use in dressing wounds. In appearance it is a white voluminous, crystalline powder. It is not hygroscopic; it melts at 120° C. and is slightly soluble in water, a fact which gives it an advantage over any other anæsthetic at present in use, for it is but slowly absorbed in consequence of its sparing solubility, and consequently a durable effect is produced. Orthoform has a remarkable effect on burns, contusions, and painful abscesses. It has also been found very beneficial in the treatment of cancer and ulceration of the throat or stomach. So free from poisonous action is it that comparatively large quantities amounting to nearly two ounces may be applied without danger in the course of a week for dusting wounded surfaces. From eight to fifteen grains have frequently been administered internally.

REPLIES TO SCIENCE QUERIES.

Acetylene.—We know nothing of the generator referred to, but we have heard of cases where acetylene has been usefully employed as a lantern illuminant. The note on acetylene in this month's Practical Teacher (Chemistry Notes) will give you some idea of the nature of this gas. From experience we can speak of the light resulting as a good one; but before finally completing purchase we should advise you to have the lantern on approval, which we should think could easily be done. We have seen a generator of this company at work for some hours, and it then behaved in a way to give confidence. As you will see from the note referred to above, the only danger is from compression, when the gas becomes a dangerous explosive.

OUR SCIENCE SECTION

THE NEWEST SCIENCE AND ART DIRECTORY.

THE commission appointed to inquire into the distribution of the Science and Art grant duly reported to Parliament the conclusions representing the fruits of their deliberations. These were embodied in a species of *interim* Directory, which was in due course commented upon in the columns of the PRACTICAL TEACHER. This out-of-date Directory lacked one very important item in the shape of the syllabuses, wherein is set out the work to be done in the various Science and Art subjects recognised by South Kensington. There was very good reason for this omission, since the syllabuses were put into the melting-pot to be re-cast, and especially that the new stage in Honours might be syllabused. After much weary waiting, behold at length the belated syllabuses—issued, be it observed, after the classes have all commenced work. If you are behindhand in returning forms to the Science and Art Department, you must submit to a fine of 2s. 6d. per diem for delay. What, then, should the Committee of Council be called upon to pay for their delay in setting before teachers their tale of bricks? It is true that Form 120, which is due at South Kensington on September 30th, may this year be kept back until October 18th; but that is not a fair set-off against the hard-won money deducted by the Department for a short-coming in which the Department has shown a greater amount of heinousness than the most peccant of procrastinating managers. Certainly the matter is a very interesting one to be kept well in mind when next a hard-pushed teacher or Hon. Secretary is behind time.

We have already dealt with the innovations, and have now only to set before our readers the changes in the syllabuses, **Honours, Parts I. and II.** This is the new departure, and it applies to all subjects excepting I. (Practical, Plain, and Solid Geometry), II. (Machine Construction and Drawing), III. (Building Construction), XXIII. (Physiography), and XXIV. (Agriculture). Roughly speaking, Honours, Part I., is the same as the old Honours syllabus, excepting that not so much stress is to be laid upon acquaintance with the results of recent research. Part II. will be a highly advanced examination, demanding a complete knowledge of the subject from every standpoint. For example, the Honours student in Inorganic Chemistry must have a good acquaintance with Organic Chemistry, and *vice versâ*.

In addition to the initiation of a new Honours Stage, there has been a recasting and a rewriting of many of the syllabuses. Thus, the syllabuses of Subjects II. (Machine Construction and Drawing), V. (Mathematics), and XV. (General Biology) have been recast, and to the last named a Section I. has been added, which may be taken as a separate stage preparatory to the elementary.

In VI. (Theoretical Mechanics), VIII. (Sound, Light, and Heat), IX. (Magnetism and Electricity), XII. (Geology), XIII. (Mineralogy), XIV. (Human Physiology), and XVI. (Zoology) the syllabus, in so far as it applies to the **Honours Stage,** has been **entirely rewritten.** Subject IV. (Naval Architecture) has a newly-written syllabus, as has also Subject VII. (Applied Mechanics). It must be admitted that the rewriting and recasting has been wisely done, resulting as it has done in bringing the South Kensington requirements more in line with modern science. There are several other minor changes, as, for example, the introduction of the preparation of bodies from printed instructions into the Advanced Stage of Practical Inorganic Chemistry, the time allowed for this examination now being **four hours.** But we need not enter into these points of detail, as students and teachers specially interested will certainly not fail to acquaint themselves therewith by first-hand reference to the syllabuses themselves. It but remains now for the Department to show a liberal spirit in estimating the worth of the work of those who, as students or as teachers, have to fulfil these new regulations, which it is to be hoped will make for progress in scientific instruction. It is to be regretted that there is no sign of a resolve to increase the very inadequate payments upon attendance, which must now universally displace the erstwhile payment upon results.

It is pretty evident that the Department mean to stand to their guns, both as to the principle of payment on attendance and not by results (which is admissible) and also as to amounts set out in the Directory (which is eminently deplorable). At least some higher rate of payment should be conceded in the case of the smaller classes, which will be improved off the face of the earth if the present scheme is obstinately persevered in and applied to large and small classes alike.

CHEMISTRY NOTES.

Moissan's Electric Furnace.—The results of Moissan's five years' work with his electric furnace has been embodied in a book of nearly 400 pages, of which both German and French editions have appeared. The French edition is published by Steinheil at 15 francs, under the title of **Le Four Electrique.** We may profitably refer to a few of the more important points in M. Moissan's treatise. The carbides of barium, strontium, calcium, and lithium are attacked by water with the formation of **acetylene**; the carbides of aluminium and glucinum yield **methane** when acted upon by water, whilst yttrium, thorium, cerium, and lanthanum give mixtures of these gases under like conditions. The carbide of manganese is decomposed by water with formation of methane and hydrogen, whilst uranium carbide acted upon by water yields hydrogen, methane, and acetylene. Acting with cold water upon the last carbide, large quantities of solid hydrocarbons result. The carbides of molybdenum, titanium, and chromium do not decompose with water at ordinary temperatures, and chromium, for the time being at all events, enjoys the distinction of being the only element forming two carbides, the compounds CCr_4 and C_2Cr_3 having been prepared by the author of 'Le Four Electrique.' Titanium, zirconium, vanadium, and silicon unite with carbon in the ratio of one is to one.

Artificial Diamonds.—A new process for producing artificial diamonds has been experimented on successfully by Dr. Majorana. The present method consists fundamentally in heating a piece of carbon by the electric arc, and then submitting it to a violent pressure by means of a small plunger actuated by a piston, on which a pressure of 5,000 atmospheres was suddenly developed by explosion. When a sufficiently strong cylinder has been constructed to withstand the enormous pressure, the experiment produced a black mass consisting largely of graphite and amorphous carbon. On employing Berthellot's method to isolate the diamonds if they existed, small microscopic crystals were obtained, mainly black and opaque, but which exhibited all the properties of true diamonds, notably in their manner of burning at a high temperature. The conclusion drawn from these experiments is that pressure and heat alone are sufficient to transform amorphous carbon into the crystalline or diamond form, and that the presence of a metallic solvent, as in Moissan's experiments, is not essential to the transformation.—*Nature.*

The Percarbonates.—A new class of oxidising substances.—If a saturated solution of carbonate of potash is electrolysed, and the temperature gradually lowered, the disengagement of oxygen gradually diminishes at the anode and finally ceases altogether at −20°C. Further, instead of a crystalline bicarbonate being formed, a bluish amorphous powder, shown by analysis to consist of $K_2C_2O_6$ results. This is percarbonate of potassium, the formation of which is explained thus: the carbonate of potassium in saturated solution first of all becomes dissociated into the ions K and KCO_3; when electrolysis intervenes two of the ions KCO_3 unite to form the body $K_2C_2O_6$. The phenomenon does not occur in dilute solutions, as the carbonate of potassium splits up into the ions K_2 and CO_3. The percarbonate obtained in the above manner should be quickly thrown on to a filter and dried over phosphoric anhydride. It is very hygrometric and decomposes water at ordinary temperature:—

$$K_2C_2O_6 + H_2O = 2KHCO_3 + O.$$

When brightly heated it decomposes thus—

$$K_2C_2O_6 = K_2CO_3 + CO_2 + O.$$

In the presence of oxidisable matters it acts as an oxidising agent; but it can also play the part of a reducing agent, as—

$$MnO_2 + K_2C_2O_6 = MnCO_3 + K_2CO_3 + O_2.$$

From these reactions it is concluded that this new body is in reality the neutral carbonate of a higher oxide, peroxide of potassium. In addition it produces, like the higher alkaline oxides and the alkaline earths, peroxide of hydrogen in the presence of acids.

The Burning of Magnesium.—As the magnesium is generally burnt in a limited supply of air, the products of combustion are grey. If a fairly large quantity of this grey substance be exposed to the air for a short time, it will be found to give off the characteristic odour of ammonia, for **the grey substance is a mixture of the oxide and the nitride of magnesium.** Water vapour acts upon the latter with the formation of ammonia and magnesium oxide.

Arsenical Poisoning by Wall Papers.—It has long been recognised that arsenical wall papers do serious mischief, but the work of Gosio and Emmerling seems to have cleared up the mystery which has surrounded the matter. Certain moulds, including the very common **mucor mucedo,** have a remarkable power of decomposing arsenical compounds with the evolution of volatile products containing arsenic; and the highly poisonous character of volatile arsenical compounds, coming into the system by way of the respiratory organs, is well known. Arsenious acid is, even in small quantities, a highly antiseptic substance and poisonous to moulds, so that throwing off of the arsenic in a volatile form may be an effort of nature to cast off the poison. The arsenical copper greens, and other colouring matters containing arsenic, are still used, and, paradoxical as it may seem, it by no means is improbable that the most dangerous wall papers are those containing a mere trace of arsenic, as when the quantity is large the moulds cannot exist. Traces of arsenic may come into wall papers from the imperfect washing vessels used to contain the more highly arsenical colours. Now that boric acid is very cheap, the old and perhaps forgotten suggestion of Bolley, to use a precipitated borate of copper as a green pigment in place of the arsenical green, deserves attention. Bolley's green is prepared by taking two parts of blue vitriol and three parts of borax in separate quantities of cold water and mixing; after which the precipitate is washed and dried. Dyed and printed fabrics now very frequently contain traces of arsenic.

Acetylene.—The Explosives Department of the Home Office has recently had under consideration the question of the restrictions to be applied to the manufacture and keeping of acetylene gas, and has conducted various experiments with the object of giving information on the matter. The results show conclusively that acetylene gas, *per se*, when under a pressure of something less than two atmospheres, is violently explosive; whereas at a pressure less than one and a half atmospheres it appears to be reasonably free from liability to explosion, provided it is not mixed with oxygen or atmospheric air. For commercial and practical purposes it is considered sufficient to allow a pressure of 20 inches of water above that of the atmosphere (*i.e.*, roughly about one and one-twentieth atmospheres), and it is accordingly proposed to draw the line of safety at that point, and to declare acetylene, when subject to a higher pressure, to be an explosive.

Dr. Walker Overend's Notes on Advanced and Honours Physiology will be resumed next month, and will appear regularly until the May Examinations of 1898.

PHYSIOGRAPHY NOTES.

Miss Herschell's Comets.—Mr. Lynn writes a very apropos letter to the Observatory, reminding the astronomical world of the discoveries made, a century ago, by Miss Herschell in the world of comets.

The first of these discoveries was made on August 1st, 1786, whilst her brother was on a visit to Germany.

The second was revealed to the eye of Miss Herschell on the 21st December 1788.

She discovered two additional comets in 1790; one in 1791, and again one in 1792 and 1793.

She also was the first to detect the first return of Encke's comet on November 7th, 1795; and again, in 1797, she was one of three simultaneous discoverers of one and the same comet; the two other observers being Dr. Bouvard, of Paris, and Stephen Lee, of Hackney. It is worthy of note that neither Sir William nor Sir John discovered a comet, so that all the Herschellian credit in this field of observation is to be put to the credit of sharp-eyed Miss Herschell. Not again until 1847 did a lady connect herself with cometary discovery; but on October 1st of that year Miss Mitchell discovered Comet VI. of that year.

The Cause of the Proper Motions of Stars.—When the parallax of the star 1830 Groombridge is considered in connexion with the large proper motion of 7 secs. of arc per annum, the conclusion is arrived at that the star is moving through space with a velocity which probably exceeds 200 miles per second. In his 'Popular Astronomy,' Prof. Simon Newcomb briefly discussed the problem of stellar dynamics involved in this enormous velocity. He showed that if the universe be considered of such an extent that light would take 30,000 years to cross it, and if it contained one hundred million stars, having on an average a mass five times the mass of the sun, the gravitational attraction of the universe thus constituted would only be sufficient to give a velocity of 25 miles per second to a body drawn from infinity to the centre of the system of masses. The calculated limit is thus only about ⅕ the velocity deduced from the observed proper motion and parallax. Prof. Newcomb therefore concluded, 'Either the bodies which compose this universe are vastly more massive and numerous than telescopic examination seems to indicate, or 1830 Groombridge is a runaway star, flying on a boundless course through infinite space with such momentum that the attraction of all the bodies of the universe can never stop it.'

A new contribution to the enquiry was read recently before the American Philosophical Society by Mr. Luigi d'Auria. The object of the investigation was to determine whether, assuming the interstellar ether to possess the virtue of gravitational attraction, the force exerted by it would be sufficient to account for the proper motions of stars, and especially of the flying star 1830 Groombridge. In this paper it is shown that 'given the ether, the density as estimated by Maxwell, and the power of attracting matter by gravity, a body placed within the sphere of ether containing all the stars of the visible universe, and at a distance from the centre of each sphere equal to that passed over by light in 2,000 years, would pass this centre with a velocity equal to that of 1830 Groombridge, taking into account the attraction of the ether alone; and such body would oscillate about the same centre rectilinearly with a period of a little over 7,000,000 years, which would also be the period of oscillation of every other star.' Mr. d'Auria recognises that some other, and unquestionable, cause may ultimately prove to be responsible for stellar proper motions; nevertheless, he thinks his results are worth putting on record.

Comets due in 1898:—

(1.)	Winniche's comet,	due in	April.
(2.)	Encke's	,, ,,	May.
(3.)	Swift's 1887, VI.	,,	June.
(4.)	Wolf's	,, ,,	June.
(5.)	Tempel's 1867, II.	,,	Sept.

The Central Meteorological Office of France has just issued an interesting report. In the first place, it is shown that of thirty-four storms visiting France, no less than thirty-one, or 91 per cent., were foretold. Secondly, a special study has been made of clouds, of which no less than 2,500 have been photographed between July 1896 and April 1897, and the heights of 750 have been ascertained.

The Great Lakes a Sinking Area.—Prof. Gilbert and Dr. Spencer has made observations from which they conclude that the Great American Lakes are situate in an area which is sinking at the rate of **one inch in 10 years.** At this rate, in a few centuries Detroit and Chicago will be under water, lake Michigan will go to swell the mighty volume of the Mississippi waters, and in three thousand years Niagara will have disappeared.

MATHEMATICS.

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,

Mathematical Division, Royal College of Science, London, and Lecturer on Theoretical Mechanics, City of London College.

STAGE 2.

Algebra.

Quadratic Equations.—This part of the subject may now be taken up. The student may at once be told that there is one *method* by means of which all quadratics may be solved; and he had better at once become thoroughly acquainted with it; it is known under the name of *completing the square*. This will be found on Arts. 235–244, 'Hamblin Smith,' or Arts. 189–197, 'Hall and Knight.'

The *method of factors*, explained in 'Hall and Knight,' Art. 201, cannot be too highly recommended. It is strange that this method is not more widely used. The equation $6x^2 + x = 2$, may be written $6x^2 + x - 2 = 0$, or $(3x + 2)(2x - 1) = 0$, hence either $3x + 2 = 0$ or $2x - 1 = 0$; that is $x = -\frac{2}{3}$ or $\frac{1}{2}$.

Work about 30 examples selected from the sets of examples in Chap. IX., H.S., or Chap. XXV., H.K., employing both the methods above referred to.

Work the following problems.

A tradesman buys a certain number of vases for £3 12s.; after breaking 4 of them, he sells the rest at a profit of 9s. each, and in this way neither loses nor gains; how many vases did he buy? Ans. 8

Two persons, A and B, start on a journey of 110 miles at the same time; A travels one mile an hour faster than B, and arrives one hour before him; find their rates of travelling.
Ans. 12, and 11 miles per hour.

An article is sold for £9 at a loss of as much per cent. as it is worth in pounds; find its value. Ans. £10 or £90.

Trigonometry.

To the *six* trigonometrical ratios of an angle already learnt may now be added a *seventh*, which may be defined in the following manner:—Draw any angle XOY; with O as centre describe an arc, with *any* radius, cutting OX and OY in A and B respectively, then, *length of arc AB ÷ radius* is called the *circular measure* of the angle XOY. There is, of course, a particular angle, such that the arc is equal in length to its radius; it is called a **radian.** It is the *unit angle* in this system of measuring angles, for *arc ÷ radius* is, in this case, 1. If, for example, an angle is such that the arc is $2\frac{1}{2}$ times its radius, we say its *circular measure* is $2\frac{1}{2}$, and we mean that it is $2\frac{1}{2}$ *radians*.

Now what is the size of a radian, reckoned in degrees? Well, a semicircle is the arc which subtends an angle of 180°, and is $3\frac{1}{7}$ times the radius, hence $180° = 3\frac{1}{7}$ radians, and therefore

$$\text{a radian} = \frac{180°}{3\frac{1}{7}} = 57{\cdot}29°.$$ * The Greek letter π is universally used instead of $3\frac{1}{7}$, so that 180° contains π radians; *this must be remembered.*

Ex.—How many radians are there in 48°?

We must find how many times 48 contains 57·29; this is

$$\frac{48}{57{\cdot}29} \text{ or } \frac{48}{\frac{180}{\pi}} = \frac{48\pi}{180} = \frac{4\pi}{15} = {\cdot}838.$$

Work Exs. VIII. and IX., H.S.; *or* Exs. IX., No. 2 in 'Lock;' or Exs. III., Nos. 1 and 9 to 13, in 'Loney.'

The student may now consider the numerical values of the six trigonometrical ratios for certain angles which frequently occur in examples, namely, 0°, 30°, 45°, 60°, and 90°. *These must not be learnt* in the manner in which one learns his alphabet. (1) He must know the definitions of the ratios thoroughly. (2) For the cases of 30° and 60° he must be able to draw, with fair accuracy, a right-angled triangle which contains these two angles, and then to place correctly the numbers 1, 2, $\sqrt{3}$ on the sides of such a triangle. He cannot then fail to write down any ratio correctly. The same remarks apply to 45°, for which he needs to draw an isosceles right-angled triangle and to place correctly the numbers 1, 1, $\sqrt{2}$ on the sides. We say 'draw' the triangle, but, of course, a mental picture of the triangle will suffice. Let the student make no mistake about this. If he be asked for the sine of 60°, he must go through a *process* rather than depend on a mere effort of memory.

Work Exs. XIV., H.S., *or* Exs. XIII., 'Lock;' or Exs. VII., Nos. 3 to 6 and afterwards 1 and 2 in 'Loney.'

* A student's education is generally such that he is taught to measure an angle in degrees. If he sees an angle, he judges of its size and says it is 30° or 35°, or whatever it may be. Now there is no reason why he should not learn to roughly measure angles in radians, and to do this, he must have a fairly correct idea as to the size of a radian.

STAGE 3.

Algebra.

The three Progessions.

Read in 'Todhunter,' Arts. 448–445, 460; 462–465, 469, 473; 474–478. Or in H.K., Arts. 38–47; 51–57, 60; 61–65; 67, 68.

A few suggestions may be of use to students:

1. After learning what is meant by an A.P., G.P., or H.P., let him make up a dozen of these for himself, both numerical and literal series, and then write down, say, the 20th, 40th, or n^{th} term, until this becomes an easy matter.

2. Write down a series in A.P., and another in G.P. each day during a week, and find the sum of each to 10, 20 or n terms. Do not make the least effort to remember the formula for the sum of such a series, but establish it each day, as it is done in the text book. This requires much patience, but the student who exercises it will be amply rewarded.

3. Write down any two numbers or any two letters and write down the Arith. Mean, the Geom. Mean and the Harm. Mean, and observe that the three means are in G.P. Now insert two means between these two quantities.

4. Observe that if the n^{th} term of a series is $2n + 3n^2$, then the series itself is obtained by putting, in succession, $n = 1, 2, 3,$ etc.

5. Observe the form of the series in Art. 60, H.K., and Art. 473, 'Todhunter.' The series formed by taking the first factor of each term is an A.P., that formed by taking the second factor of each term is a G.P. The sum of such a series is found by multiplying all through by the common factor of the G.P., and then subtracting, thus obtaining a simpler series; in this case a G.P. But if a given series be not of the form in these Arts., a summation is often effected by a similar step, that is, multiplying throughout by such a factor that on subtracting a simpler series is obtained. Sometimes a second multiplication and subtraction is necessary.

Thus in the series $5 + 55 + 555 + \ldots$ by multiplying all through by 10 and subtracting we get a simpler series, thus—

$$\begin{aligned} s &= 5 + 55 + 555 + \ldots \\ 10s &= \quad 50 + 550 + \ldots \\ -9s &= 5 + \quad 5 + \quad 5 + \ldots \end{aligned}$$

from which s for a given number of terms could be easily found.

Work examples selected from the text-book, and also the following:—

1. Find the sum of all numbers divisible by 12 which lie between 36 and 456. Ans. 4,182.

2. The 7th term of an A.P. is 15, and the 21st term is 8; find the sum of the first 13 terms. Ans. 195.

3. If the common ratio of a G.P. be less than $\frac{1}{2}$, show that each term will be greater than the sum of all that follow it.

4. If a, b, c are in A.P. and b, c, d be in H.P., then will $a : b = c : d$.

5. If a, b, c are in A.P. and x, y, z in G.P., show that $x^b y^c z^a = x^c y^a z^b$.

6. The series of natural numbers is divided into groups as follows:

1; 2, 3; 4, 5, 6; 7, 8, 9, 10; and so on.

What is the first number in the r^{th} group, and what is the sum of the numbers in that group?

Ans. $\frac{1}{2}(r^2 - r + 2)$; $\frac{r}{2}r(r^2 + 1)$.

7. If a, b, c be in A.P., and a^2, b^2, c^2 be in H.P, prove that $-\frac{a}{2}, b, c$ are in G.P., or else $a = b = c$.

Trigonometry.

In working at his elementary trigonometry up to, say, the solution of triangles, a student has to deal with a considerable number of formulæ. It generally happens that he pays too much attention to the mere *letters* which occur in the formulæ, and too little attention to the *form* of the expressions which enter into the formula. To illustrate our meaning, take the case of the fundamental formula,

$$\sin(A + B) = \sin A . \cos B + \cos A . \sin B,$$

and three others which accompany this.

The letters A and B seem to form so important a part of the expression, that when he sees

$$\sin(45^\circ + A) \cdot \cos(45^\circ - B) + \cos(45^\circ + A) \cdot \sin(45^\circ - B)$$

his attention is directed more to the $45^\circ + A$ and $45^\circ - B$, than to sin . cos + cos . sin, and he is apt to take the first part, viz., $\sin(45^\circ + A)$ and expand it, and do the same with the other terms, and thus obtain very lengthy expressions. Whereas if he were more in the habit of observing the *form* of the expression, that is, the way in which the sine and cosine occur, he would see at once that the expression is really the same as the one above, $45^\circ + A$ being put for A, and $45^\circ - B$ for B; thus the expression is equal to

$$\sin[(45 + A) + 45 - B] = \sin[90 + (A - B)] = \cos(A - B).$$

In the same way he ought to see *at a glance* that

$$\sin(n + 1)\,A \cdot \sin(n + 2A) - \cos(n + 1)\,A \cdot \cos(n + 2)\,A = \cos A.$$

$$\cos(45 - A) \cdot \cos(45 - B) - \sin(45 - A) \cdot \sin(45^\circ - B) = \sin(A + B).$$

We should like to repeat what was said last month with regard to the formulæ for sin (A + B), etc., and cos 2A and sin 2A, but space does not permit it, and even if it did, we fear it is impossible to sufficiently impress the student with the importance of this part of the subject. To those formulæ might be added those for sin 3A, cos 3A, tan 3A.

For example, $\sin 3A = 3\sin A - 4\sin^3 A$, but it is not enough to learn it just in this shape, he ought to be ready to put

$$\sin^3 A = \tfrac{1}{4}(3\sin A - \sin 3A).$$

If sin 3A occur in an example, then one is fairly ready to put $3\sin A - 4\sin^3 A$ for it, but not so ready to put

$$\tfrac{1}{4}[3\sin(A + B) - \sin 3(A + B)] \text{ for } \sin^3(A + B).$$

If a student does his work thoroughly, he will be equally ready in the two cases.

It will probably appear to many readers that we are spending too much time here. However, we are only asking the student to study and examine a formula well, and to put it in words, to say what it may be used for, and the different purposes for which it may be used; in short, not to be content with learning it just as it may be put in a text-book.

NOTES ON THEORETICAL MECHANICS.

BY F. CASTLE, M.I.M.E.

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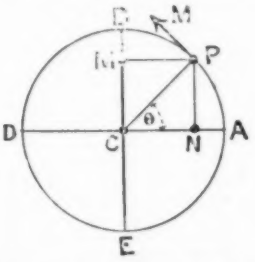
ADVANCED AND HONOURS STAGES.

(*Continued from page* 220.)

Harmonic Motion.

This is a subject of great importance, not only in Mechanics but also in the theories of sound, light, heat, etc., *i.e.*, the principle applies to the oscillation of particles of air, tuning forks, stretched wires, etc.

The motion of a point moving in a straight line is a *simple harmonic motion*, when *the acceleration of its velocity is directed towards a fixed point in the line, and proportional to its distance from that point.*



Thus if a point P *moves uniformly* in a circle ABDA of radius r, with velocity v, and a perpendicular PN be drawn intersecting any fixed diameter AD at N, then N is the projection of P on AD, and the point N has a *simple harmonic motion*; also M (the projection of P on BE) has a S.H.M.

We have already found that a constant acceleration of magnitude $\frac{v^2}{r}$ and in direction PC is necessary to keep P moving in a circular path. To find the acceleration of N we may proceed as follows:—

The acceleration of N is the component of the acceleration of P in the direction of NC, that is *towards the middle of its path*; hence the acceleration of N is $\frac{v^2}{r}\cos\theta = \frac{v^2}{r} \times \frac{x}{r} = \underline{\omega^2 x}$; (1)

Where θ denotes the angle PCN.

" x " distance CN.

And ω the angular velocity of P.

In (1), as ω^2 is constant, the motion of N is always proportional to its distance from the middle of its path, and as it is always directed to that point it is therefore a *simple harmonic motion.*

The distance x is called the displacement of N, hence in simple harmonic motion $\frac{\text{acceleration}}{\text{displacement}} = \frac{\omega^2 x}{x} = \omega^2 = a\ constant.$

This is one of the most important results in Dynamics, and the student is advised to carefully note it and not necessarily commit to memory, but write it out carefully in his own words.

If n be the number of revolutions of P per sec., t the time of a revolution in seconds, then $nt = 1$, or $n = \frac{1}{t}$, also $\omega = 2\pi$ for one revolution $= 2\pi n$ for n revolutions.

The result can be put in the following forms, often required in problems:—

$$\frac{\text{acceleration}}{\text{displacement}} = \omega^2 = 2^2\pi^2 n^2 = \frac{2^2\pi^2}{t^2}$$

Let f denote the acceleration of N, and m mass of N.

Then $f = \omega^2 x$; multiplying both sides by m,

$$\therefore mf = F = m.\omega^2.x \quad (2)$$

$$= m.2^2.\pi^2.n^2 x = \frac{m.2^2\pi^2}{t^2}x, \quad (3)$$

where F is the force in poundals.

(To obtain F *in pounds* divide by g.)

From (2) the force and acceleration are each zero when x is zero.

$\therefore$ when P is at B or E, N is at the instant considered moving at the same speed as P.

F and f have their maximum value when x is a max., *i.e.*, when P is at A or D.

The following definitions are important:—

The *displacement* CN at any instant is the distance of N from its mean position C.

The *amplitude* CA or CD is the greatest displacement of N on each side of its mean position.

The *period* (or *periodic time*) is the time taken by the point P in moving from A until it again passes through A at the same speed and in the same direction as before.

The *phase* is the fraction of the period which has elapsed since the moving point was at A. Thus if $\theta = 45^\circ$, then the phase would be $\frac{1}{8}$ (as $45^\circ = \frac{1}{8} \times 360^\circ$).

The *epoch* is the interval taken by the moving point to pass from its position of greatest displacement in positive direction to its position at zero of time.

It is easily seen from Eq. (3) that when a point N is moving in simple harmonic motion in a straight line the *Period is independent of the amplitude.*

Thus the force is $\frac{m.2^2\pi}{t^2}x$ when the point N is at x feet from C.

The *Period* t seconds is the time taken by P to describe one revolution $= 2\pi r$ feet. Hence $2\pi r = vt$.

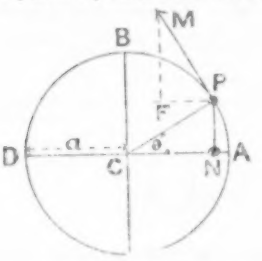
$$\therefore t = \frac{2\pi r}{v}$$

$$\text{or } t^2 = \frac{2^2\pi^2 r^2}{v^2} = \frac{4\pi^2 r^2}{\omega^2 r^2} = \frac{4\pi^2}{\omega^2}$$

Hence the period t is $\frac{2\pi}{\omega}$ seconds, which is therefore independent of the amplitude r.

Therefore so long as the force F acting on the mass N at the distance x remains constant, the *period* will be the same, and the oscillations are *isochronous.*

The linear velocity v of P is along the tangent PM, the *velocity of* N is the resolved part of v parallel to the line AD.



$\therefore v \cos \text{MPF} = v \sin \theta = v. \frac{\text{PN}}{a}$, where a is the amplitude CA.

If P starting from point A is at P in t seconds, then angle $\theta = \omega t$.

$\therefore$ Velocity of N $= a \sin \omega t$. (1)

where ω (the angular velocity of P) may have any value 0 to 2π, or any multiple.

Also since $\sin \theta = \frac{\text{PN}}{a}$,

$$\therefore v \sin \theta = \frac{\omega a \times \text{PN}}{a} = \omega \times \text{PN}$$

$$= \omega \sqrt{a^2 - x^2}. \quad (2)$$

From Eq. (2) the velocity of N is greatest when x is zero (this occurs when N is at C), and is zero when $x = a$ or $-a$; $\therefore$ when N is at A or D.

Ex. A mass of 96lbs. has a S.H.M. with period $1\frac{1}{8}$ second and amplitude 5 ft. Find its kinetic energy when its phase is $\frac{1}{8}$ ($g = 32$). Ans. $72\pi^2$.

(Solution.—At phase $\frac{1}{8}$ the angle θ is $\frac{360}{8} = 45°$; velocity of P $= \frac{2\pi . 5}{\frac{9}{8}} = 12\pi = v$. $\therefore$ vel. of mass $= v \sin 45° = \frac{12\pi}{\sqrt{2}}$, and hence the kinetic energy $= \frac{96 \times \frac{12^2 \times \pi^2}{2}}{64} = 72\pi^2$).

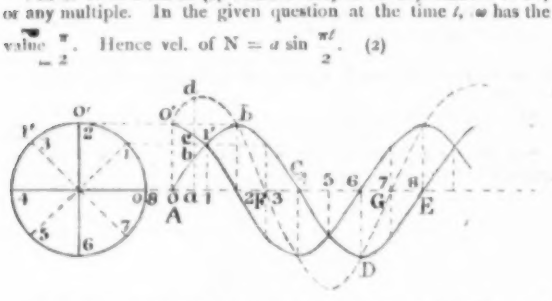
The motion of N may be set out in a sinous curve, and becomes the well-known curve of sines; also N may be the recipient of more than one harmonic motion in the line AD, or combined with the motion in the line AD it may have a harmonic motion in the perpendicular line BC. The following will illustrate the former case:—

Ex. Define the amplitude, epoch, and period of a simple harmonic motion.

A point has two harmonic motions in the same line, the velocities are respectively $a \sin \frac{\pi t}{2}$ and $a \sin \left(\frac{\pi t}{2} + \frac{\pi}{2}\right)$; find the *greatest* velocity of the resultant motion. Represent by curves the successive velocities of the point due to the motions respectively and to the resultant motion. 'Fluids.' (1896).

Let N denote the point referred to, then

Vel. of N $= a \sin \omega t$ (1) where ω may have any value 0 to 2π, or any multiple. In the given question at the time t, ω has the value $\frac{\pi}{2}$. Hence vel. of N $= a \sin \frac{\pi t}{2}$. (2)



The successive velocities of N will be represented by the well-known sine curves where ordinates $o\,o^1$, etc. denote velocity, and abscissa $o\,4$ denote time, and which is easily drawn by dividing the circle into a number of equal parts, 1. 2. . . . . 8, and the straight line on which as axis the curve is shown into the same number, or if in Eq. (2) values 0. 1. 2. . . . . be assumed for t, the corresponding ordinates of the curve can be found; thus when $t = 0$ then the ordinate $y = 0$, when $t = 1$, $y = a$ (the radius of the circle or) the *amplitude*.

Let $y_1 = a \sin \left(\frac{\pi t}{2} + \frac{\pi}{2}\right)$

If $t = 0$, $y_1 = a$

,, $= 1$, $y_1 = 0$

etc. etc.

Proceeding in this manner the curve is easily seen to be similar to the one already drawn, but starting at o_1, the resultant curve is found by adding at every point 1 . 2 . 3, ... the ordinates of the curves algebraically; thus at a the ordinate ab is added to the ordinate ac, giving the point d. Other points can be obtained in like manner and the dotted curve drawn; the greatest velocity will be at the point where the ordinate of the dotted curve has its greatest value.

Each one of the equal intervals 01, 12, ... 78, into which the period of the simple harmonic motion has been divided is called a *phase*; thus when the point is at 1 its phase is $\frac{1}{8}$, at 2 its phase is $\frac{2}{8}$, etc. Although the S.H.M. of a point which has two harmonic motions only is set out, it is advisable to note the general application of the method. The sine curves just described are called *waves*. The wave-length may be defined as the distance travelled by the vibrating point while the point which starts it is making one revolution. Thus A B represents the wave-length, so that each wave-length consists of a crest and a trough. A wave in passing through any medium will encounter other waves, giving what is termed *wave interference*; hence it becomes necessary to combine two or more. The combination is shown by the resultant, which is such that the ordinate or resultant velocity of the resultant at any point is equal to the sum of the velocities of the separate waves. As already stated, the law is important because it applies to waves of all kinds. In dealing with water we should refer to the *crests* and *troughs* B and D; in air the names given to these would be *condensations* and *rarefactions*.

The resultant may be zero. This is shown at F + G where the dotted curve crosses the axis; this, if applied to sound-waves, would mean that the sound-waves are equal in velocity but opposite in phase; the resultant is therefore silence.

The *greatest* value may also be obtained as follows:—

Let R denote the resultant velocity.

$$\therefore \text{R} = a \sin \frac{\pi t}{2} + a \sin \left(\frac{\pi t}{2} + \frac{\pi}{2}\right); \quad (3)$$

$$\text{or if } \phi = \frac{\pi t}{2}$$

$$\text{then R} = a \sin \phi + a \sin \left(\phi + \frac{\pi}{2}\right).$$

To find the maximum value, differentiate and equate to zero in the usual manner.

$$\therefore \frac{d\text{R}}{d\phi} = a \cos \phi + a \cos \left(\phi + \frac{\pi}{2}\right);$$

$$\therefore a \cos \phi + a \cos \left(\phi + \frac{\pi}{2}\right) = 0;$$

$$\text{or } \cos \phi = -\cos \left(\phi + \frac{\pi}{2}\right)$$

$$= \sin \phi;$$

$$\therefore \tan \phi = 1,$$

$$\text{or } \phi = 45°.$$

$$\text{Hence from Eq. (3)} \quad \text{R} = \frac{a}{\sqrt{2}} + \frac{a}{\sqrt{2}} = a\sqrt{2}.$$

Ex. 1. Define a simple harmonic motion, and show how it can be represented (*a*) graphically by a diagram, (*b*) by a formula. Define the amplitude, epoch, period, and phase of a simple harmonic motion. (1892.)

Ex. 2. A straight tube is filled with air; a disc which nearly fills a section of the tube oscillates rapidly through a small distance within the tube. Describe the disturbance propagated along the tube, particularly the condensation and rarefaction set up. Define the phase of a vibration and the length of wave. (1893.)

Ex. 3. If an undulatory disturbance is transmitted along a tube, and the displacement of a particle is represented by the formula—

$$a \sin \frac{2\pi}{\lambda} (vt - x)$$

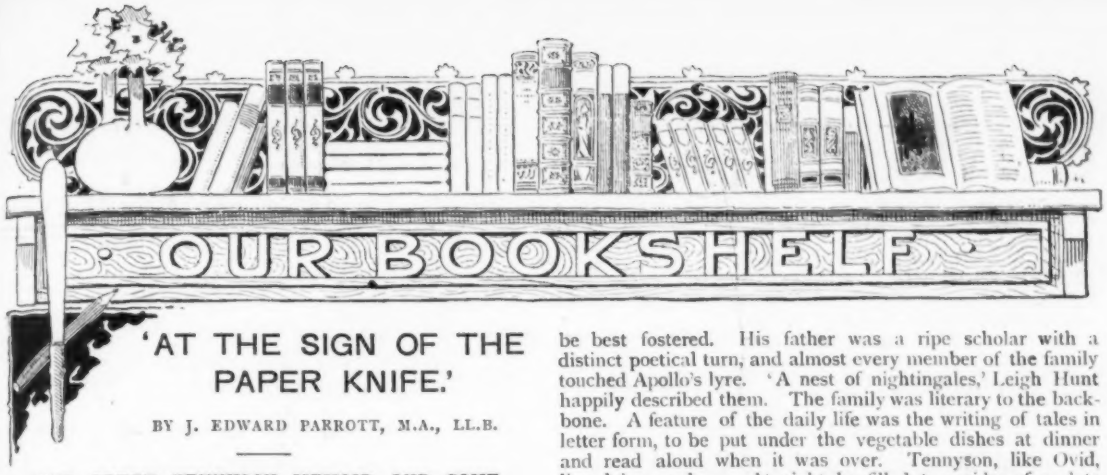
what is denoted by the letters a, λ, v, t, x?

P and Q are two fixed points in the tube; find from the formula the time it takes the disturbance to pass from P to Q; and hence show that v has the meaning you have assigned to it. (1894.)

Ex. 4. When a line of aerial particles transmits two distinct sets of vibrations, show how to represent graphically the successive displacements of ony one of the particles.

Draw the diagram carefully when the time of one vibration is half that of the other. (1895.)

Mr. Edser's Notes on Electricity and Magnetism will be continued next month.



'AT THE SIGN OF THE PAPER KNIFE.'

BY J. EDWARD PARROTT, M.A., LL.B.

THE GREAT TENNYSON MEMOIR AND SOME MINOR THINGS.

ONE rises from the Book of Poetic Revelation*—the enduring tribute of an affectionate son to the memory of a great father—with a positive exaltation of spirit, as though fresh from close communion with kings of men. Tennyson, 'in his simplicity, sublime,' is the central figure, and around him are grouped the great Victorian writers and thinkers, poles asunder in many things, but united in reverence and admiration for the moral grandeur, the splendid truth, the marvellous workmanship, and the lofty genius of the poet who has unfailingly written his songs on the hearts of his countrymen. It is too early to fix Tennyson's place on the scroll of the Immortals; but, however Posterity may deal with his work, this is certain, that no poet of any age has more earnestly taught to his own time the beautiful lesson of—

> 'High thought and amiable words,
> And courtliness, and the desire of fame,
> And love of truth, and all that makes a man.'

Tennyson has realised to our age the ideal personality of the poet—a being stamped among men with the seal of genius, lifted above the world, yet of it, speaking in the voice of the gods, charming the way to higher things, yet nobly careless of personal aggrandizement and popular applause. His magnificent frame, his high-domed Rembrandt-like head, his cherished seclusion, 'half hid in light, half veiled in cloud,' his wonderful faithfulness to his gift, and his high poetic achievement, have impressed the popular imagination in an extraordinary degree. Tennyson of all men needed a biography. Indeed, much of his work is imperfectly gauged, unless read in the light of his life's story. His horror of publicity, and his scorn of the arts of advertisement, are well known. 'The poet's work,' he thought, 'is his life, and no one has a right to ask for more.' He hated 'the pen punctures of those parasitic animalcules of the press,' and he felt keenly the force of the remark, that indiscriminate biography has added a new terror to death—

> 'While I live, the owls,
> When I die, the GHOULS!!!'

But the 'Ghouls' have been foiled. 'My father,' says Hallam, Lord Tennyson, in a preface of exquisite sensibility and delicate skill, 'wished that if I deemed it better, the incidents of his life should be given as shortly as might be without comment, but that my notes should be final and full enough to preclude the chance of further and unauthentic biographies.' This has been done with a 'discriminating love' and a self-effacing art that lifts the memoir at once into the company of the best biographies ever written. To indicate even a tithe of the interpreting incidents of birth, home, school, college, friendship, and travel, which give an insight into the poesy of the man, is, of course, impossible in these straitened columns. I can do no more than glance briefly and imperfectly at the great book.

* * * * *

The main outlines of Lord Tennyson's story are a matter of school-book history. '*Poeta nascitur* et *fit*,' he said, following Ben Jonson, and surely the poet born, was ushered into the very surroundings where his genius might be best fostered. His father was a ripe scholar with a distinct poetical turn, and almost every member of the family touched Apollo's lyre. 'A nest of nightingales,' Leigh Hunt happily described them. The family was literary to the backbone. A feature of the daily life was the writing of tales in letter form, to be put under the vegetable dishes at dinner and read aloud when it was over. Tennyson, like Ovid, lisped in numbers. At eight, he filled two sides of a slate with Thomsonian blank verse; at twelve, he wrote an epic of six thousand lines 'à la Scott'; at fourteen, a blank verse drama. Before he could read he would spread out his arms to the wind and cry, 'I hear a voice that's speaking in the wind.' An elegy on his grandmother earned him a half guinea from his grandfather, and the remark, 'the first money you have ever earned by poetry, and take my word for it, the last.' His education was mainly directed by his father, and to his careful scholarship must be ascribed Tennyson's 'love of the perfection of classical literary art, his sympathy with the temper of the old world, and his love of the old metres.' Some of his boyish unpublished poems are printed in this book. 'They are most original,' says Jowett, 'and it is wonderful how the whelp could have known such things.' When, in 1827, he followed his elder brother to Trinity College, Cambridge, his appearance was so striking that Thompson, afterwards Master of Trinity, cried out, 'That man must be a poet.'

* * * * *

College life, for Tennyson was chiefly remarkable for its friendships. Amongst the men he 'grappled to his soul with hooks of steel,' were Spedding (author of Life of Bacon,) Milnes (Lord Houghton), Trench (Archbishop of Dublin), Alford (Dean of Canterbury), Brookfield, Blakesley (Dean of Lincoln), Thompson, Stephen Spring Rice, Merivale (Dean of Ely), Kemble, Heath (Senior Wrangler, 1832), Charles Buller, R. Monteith, Tennant, and above and beyond all, Arthur Hallam. The 'Apostles,' as the friends came to be called, were intolerant of the dead and lifeless studies then in vogue at Cambridge. A rich and glowing sonnet of Tennyson's, hitherto unpublished, takes the University of his day sorely to task:—

> 'The lips of little children preach
> Against you, you that do profess to teach,
> And teach us nothing, feeding not the heart.'

It was, however, at Cambridge that Tennyson first felt that attraction towards physical science, which afterwards penetrated his verse to the admiration of professed astronomers and botanists. In 1833 the great upheaving sorrow of his life came about, the death of Arthur Hallam—a mental and moral shock out of which ultimately arose the magnificent threnody, 'In Memoriam.' For ten years after 1832 he published nothing, patiently polishing and perfecting his art, reflecting, reading, pondering much. He had no thought of a profession. He preferred 'his poverty and his golden dreams.' In 1842 he was in London, amply, though not yet popularly appreciated as the seer of 'a world of bright visions set floating in sound.' Here he met Carlyle, who has given us the most graphic portrait of him extant:—

> 'One of the finest-looking men in the world. A great shock of rough, dusty dark hair; bright, laughing hazel eyes; massive aquiline face, most massive yet most delicate, of sallow brown complexion, almost Indian looking, clothes cynically loose, free-and-easy, smokes infinite tobacco. His voice is musical, metallic, fit for loud laughter and piercing wail, and all that may lie between; speech and speculation free and plenteous; I do not meet in these late decades such company over a pipe!'

While Carlyle was being converted to Tennyson's poetry and Rogers was declaring that Shakespeare 'could not have done "Locksley Hall" better,' a business failure brought upon the poet a season of real hardship and trial, from which he was

* 'Alfred, Lord Tennyson.' A Memoir by his Son. 2 vols. London: Macmillan.

relieved by Sir Robert Peel's timely offer of a pension of £200 a year. It was Carlyle who roused Richard Milnes, fearful of his constituents, to action in the matter. 'Solemn and emphatic was Carlyle's response: Richard Milnes, on the Day of Judgment, when the Lord asks you why you didn't get that pension for Alfred Tennyson, it will not do to lay the blame on your constituents. It is *you* that will be damned.' Peel was doubtful whether or not to prefer Sheridan Knowles' claim. He was asked to read 'Ulysses.' He did so, and Tennyson got his pension.

* * * * *

The *annus mirabilis* of Tennyson was 1850, when 'In Memoriam' appeared, and he became Poet Laureate. In that year, too, he married Emily Sellwood. 'The peace of God,' he said, 'came into my life before the altar when I wedded her.' 'Perfect mother,' he called her, 'and very woman of very woman.' She, 'with her tender spiritual nature and instinctive nobility of thought,' was his literary adviser, his critic on the hearth, and the unpublished poems in this volume are a splendid testimony to her selective faculty and literary insight. Though the chips from his workshop which are scattered through these two volumes would have made an ordinary reputation, they do not in the bulk go to swell Tennyson's poetic fame. Only the most fastidious criticism, however, could have refused print to certain of them. Tennyson's opinion of his rejected verses may be gathered from his remark, 'Why do they treasure the rubbish I shot from my full-finished cantos?' In the interludes of the Crimean War, he began 'Maud,' his best-abused poem. 'The Charge of the Light Brigade,' was written on December 2nd, 1854, after he had read *The Times*' description, and while the phrase 'Someone had blundered' was ringing in his ears. The poem was dashed off at a white heat in a few minutes. The beautiful dedication of the 'Idylls of the King' in December 1861, brought the Queen and Tennyson together, and opened a unique friendship, strangely warm and affectionate, between Sovereign and subject.

* * * * *

The Memoir is a work to live with, not to review, to read again and again, and in the light of its story to discover new truth and deeper beauty in the poems it illuminates. Especially beautiful is Hallam Tennyson's account of his father's old age, the age he watched and cherished with more than filial devotion. Here we have the familiar converse of Tennyson and his friends, their humours, their refinings, their intellectual pastimes, the 'something-nothings,' that go so largely to make up a coherent picture. Mark the man in his later days.

> With his crook-handled stick, and accompanied by my brother, or myself, or a friend, and by a dog, he would tramp over hill and dale, not caring if the weather were fair or foul, every now and then stopping in his rapid walk to give point to an argument or an anecdote. When alone with me, he would often chant a poem that he was composing, and add fresh lines. There was the same keen eye as of old for strange birds and flowers, and, as of old, he would make a point of looking up a strange bird or a new flower, as soon as he returned home from his walk. If a tourist were seen coming towards him, he would flee; for many would recognise from a distance his broad-brimmed wideawake (the kind of hat that Carlyle, Sir Henry Taylor, and others of his contemporaries wore), and his short blue cape with velvet collar, and would deliberately make for him in order to put some question. His hours were quite regular; he breakfasted at 8, lunched at 2, dined at 7. At dessert, if alone, he would read to himself, or if friends were in the house, he would sit with them for an hour or so, and entertain them with varied talk. He worked chiefly in the morning over his pipe, or in the evening after his pint of port, also over his pipe.

* * * * *

'The poet's life,' says Milton, 'should be itself a poem.' In boyhood, in manhood, in decline, and even in death, Tennyson fulfilled the canon to the letter. Was ever poetic life more beautifully rounded off to the sleep which is the awakening?

> For the next hours the full moon flooded the room and the great landscape outside with light, and we watched in solemn stillness. His patience and quiet strength had power upon those who were nearest and dearest to him; we felt thankful for the love and the utter peace of it all; and his own lines of comfort from 'In Memoriam' were strongly borne in on us. He was quite restful, holding my wife's hand, and as he was passing away I spoke over him his own prayer, 'God, accept him! Christ, receive him!' because I knew that he would have wished it.

* * * * *

It would seem to be especially appropriate in this column to collect from the memoir the few scattered dicta of Tennyson concerning education. Towards 'men, my brothers, men, the workers,' his heart was warm—

> 'Plowmen, shepherds have I found, and more than once, and still could find,
> Sons of God, and kings of men, in utter nobleness of mind.'

When the Education Bill of 1870 was passed, Tennyson rejoiced and admired Mr. Forster's courage. Citizenship in its highest sense was impossible, he thought, without education. 'No education, no franchise,' was his epigram. The two greatest questions of the time, he believed, were 'the housing and education of the poor man before making him our master, and the higher education of women.' The sooner woman finds out that 'woman is not undevelopt man but diverse,' the better it will be for the progress of the world.

> 'I said God made the woman for the man,
> And for the good and increase of the world.'
> 'Parson,' said I, 'you pitch the pipe too low.'

As for children, he loved them all. Babies were 'the prophets of a mightier race.' 'Make the lives of children,' he said, 'as beautiful and as happy as possible.' One of his regrets was, 'they use *me* as a lesson book at schools, and they will call me "that horrible Tennyson!"' Though classical to the finger tips, he thought there were 'many boys who would be far better equipped for their life's work if they learnt modern languages, or had a scientific training, instead of spending so many years on Latin and Greek, but that these ought to be made to study the old stories of heroism in good translations.' One day he quoted Plato's saying, though not with approval: 'Of all wild beasts, boys are the most unmanageable.'

Mr. Christie Murray's latest book ('My Contemporaries in Fiction,' Chatto & Windus) is a protest against the puffery and hysteria of what passes to-day for criticism. Critics, he says, are suffering from 'an epidemic of kindness.' They have fallen from their high estate and are merely professional admirers. After reading certain recent savage and slaughterly notices of 'The Christian,' for example, I imagine there are still men abroad who have not yet eliminated all the gall and wormwood of their critical natures; but Mr. Murray is emphatic. 'In their over friendly eyes every painstaking apprentice in the art of fiction is a master, and hysterical school-girls, who have spent their brief day in the acquisition of ignorance, are reviewed as if they were so many Elizabeth Barrett Brownings or George Eliots.'

* * * * *

Especially is Mr. Murray angry with the critics who are for ever discovering writers to rival, if not surpass, poor Sir Walter. Our literature is in danger of degradation from this beslaverment of praise; readers are being continually misled; the sense of proportion is lost, and it is high time some ruthless, common-sense person came along to hold up the real standard of excellence, and to haul down the flags of men, honest enough in their way, but exalted by the superlatives of undiscriminating critics to a ridiculous eminence. Mr. Murray is going to be this Cromwell amongst the images; but, after all, he is a very courteous and gentlemanly protestant. He does not go out a-swashbuckling, breathing fire and slaughter. His condemnations are, for the most part, measured and dignified judgments, and he is animated by a very evident desire to search diligently for whatever fruit is hidden away among the leaves. Appreciation attracts him more than depreciation, and he is fain to confess on his last page that with every desire to be honest he has so often been compelled to praise. His chapters remind me of the sermons which so heartily met with Lord Chancellor Thurlow's approval—'fifteen minutes long with a leaning towards mercy.'

* * * * *

Mr. Harold Armitage, known to many of my readers as a member of the staff of the *Schoolmaster*, holds the place of honour in last month's *Temple Bar* with a series of finely-wrought vignettes from the life of Greuze—'A Painter of

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* * * * * *

Leaving for the nonce, her god-like guardsmen, lazily lolling in satin and perfuming their hyacinthine locks with the choicest odours of Bond Street, what time they rested from working havoc in the feminine breast, Ouida in her latest book, 'An Altruist,' presents a slight but cleverly developed story of a young man whose aspirations—noble enough in their way—succumbed to the stress of his environment. The hero, an advanced socialist in theory, endeavoured to live up to his professions by contemplating marriage with the daughter of his washerwoman. Convention, training, aristocratic and inherited prejudice, and above all, a lapse into love with a girl in society, wrecked the weak-kneed one's intentions, and everybody lived happily ever afterwards. The book will serve for an idle hour, and, slightly recast, would not make a bad comedy.

* * * * *

Mr. Charles Morley's book, 'Studies in Board Schools,' [Smith, Elder], is timely and convincing. It comes in a moment when the Board School and all its works is 'anathema' to certain so-called educationists and when vetoes and limitations are urged with a plausibility that appeals powerfully to the mere ratepayer. The Board Schools of London are *terra incognita* to the man in the street. He has been encouraged by dishonest opponents of the system to believe that they are expensively conducted palaces where 'clever devils' are fostered. Let him read Mr. Morley's book. If he does not alter his opinion and regard them as great engines of moral amelioration, doing a work of grand philanthropy, he is lost eternally. Mr. Morley's work is not a debauch of sentimentalism and imagination, but an accurate and precise picture of things as they are. Mr. Jackman, Mrs. Burgwin, Mrs. Lord, Mr. Adams and other prominent London teachers figure in these pages. We have transcripts of their lessons, pages from their daily lives, the story of their efforts, their trials, their successes. The whole system comes under review from the Babies' Room to 'Eton for nothing a week.' Mr. Morley has done education in general, and London Board Schools in particular, a great service. I can only trust that his pecuniary reward will be as great as his deserts. The book is full of quotable matter, but I am reluctantly compelled to refrain. Could I work my will, I should give *in extenso* the typical Scripture lesson that concludes the book and vindicates gloriously the fair fame of the London Board teacher as a reverent, religious, and deeply earnest instructor. I subjoin, instead, a few new 'howlers':—

'What are watches for?' 'To pawn, Miss.'

The Turkeys are killing hundreds of the Europeans.

Carlyle was a man that Mr. John Morley made a speech about.

The Pyramids is a night-light. It is wax. It burns so many hours at night.

Sir Henry Ponsonby was one of the Scottish chiefs.

The Armenians were discovered by the English.

The Prime Minister is Mr. Haddon. The Speaker is his friend, who goes to houses.

The Boers are taking a lot of English people and making them work for them, and won't let the poor men come over to England to see their wives and children.

* * * * *

Two other books await the paper knife, Mr. J. S. Fletcher's charming story, 'The Builders' [Methuen], and Dr. Rolfe's 'Shakespeare, the Boy' [Chatto and Windus]. I shall have to 'cut' them. They can both afford to wait for my meed of appreciation until next month.

THE EDITOR'S TABLE.

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Animals' Ways and Claims. By Edith Carrington. Miss Carrington is the author of several of the volumes in the admirable series of 'Animal Life Readers.' The present work is the result of a further effort in behalf of the good cause of promoting the humane treatment of animals. It may be described as a collection of useful and interesting information on a number of typical animals. It is so written that it may very suitably be read by or to classes of children in day schools, or at the meetings of such societies as Bands of Mercy. But perhaps the most profitable use to which it can be applied is to treat it as a storehouse of materials for natural history lessons. The thirty sections may be obtained separately at one penny each, and so used as cheap class books. The whole work is very well illustrated with instructive woodcuts. There is a useful appendix which describes humane methods of killing animals.

CITY OF LONDON BOOK DEPOT.

Cusack's Physiography. By S. W. Davies. This is a stout volume of nearly six hundred pages, full of information on the widely diverse scientific topics included under the comprehensive, perhaps too comprehensive, term, Physiography. The syllabus which regulates the examinations of the Science and Art Department has been mainly followed, but its limits have not been strictly adhered to, and thus the student will be able to prepare for even more extensive tests, and indeed to acquire from these chapters a very full knowledge of the principles of physical science and of the facts which they serve to explain.

The book deals fully with the properties of matter, the laws of motion, the mechanical powers, the phenomena of heat, and light, the properties of water and of the atmosphere, and the various physical phenomena connected with these; then follow chapters on the measurement of space and the astronomical relations of the earth, magnetism, electricity, geological structure, and volcanic conditions. It will be readily understood from this outline of contents that the book is not one to be read hastily, and such brief notice as we have space for cannot pretend to be anything like a detailed criticism. We may say, however, that the parts we have been able to read are very clearly written, and the explanations are practical and reasonable.

The experience of the author and the high authority of the eminent scientists to which he admits his indebtedness, dispose one to a favourable opinion for which our examination of the book gives further warrant. The illustrations are numerous and distinctly helpful.

W. B. CLIVE, LONDON.

England under the Later Hanoverians, 1760–1837. By A. J. Evans, M.A., and C. S. Fearenside, M.A. This is a large section of the fourth volume of the Intermediate Text-book of English History published at the University Correspondence College Press. It occupies 500 pages, and gives in full detail, but in very compact form, the events of our country's history for about eighty years. The style is well suited for students preparing for special examinations, and their convenience is admirably served by the full analytical and chronological table of contents prefixed to the text. There is a serviceable historical map of Europe, a concise chapter on the literature of the period, and a conspectus of reigns and treaties. We can heartily recommend the volume to students.

Euclid: Books I.–IV. By Rupert Deakin, M.A. This is a masterly edition of Euclid's first four books. The author is a teacher of long experience, and while he makes no heroic attempt to supersede Euclid's method, he loses no opportunity of introducing such comments and suggestions as may help to make the study of theoretical geometry more intelligent and more interesting. The text is given clearly and without abridgment. Then in abundant concisely written notes following the propositions to which they refer are introduced assumed definitions and postulates, analyses of the proofs, alternative methods, and very useful hints for working *riders*. The collection of riders is remarkably numerous, amounting to many hundreds. On the third book alone we find there are nearly four hundred and fifty exercises. The sections on maxima and minima, limiting values, poles and polars, and the radical axis bring the student into touch with the methods of modern geometry.

The figures and the text are very clearly printed, and the book deserves hearty commendation.

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Album Géographique: Tome premier; Aspects Generaux de la Nature. In our issue for August we gave a review of the second volume of this great work, and we have now much pleasure in calling the attention of teachers and others interested in geographical study to the first volume, which has since come to hand. In it we have a collection of 500 engravings, each with its few lines of explanatory text, and all arranged in the most careful logical

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Forms for Criticism Lessons. By J. Welton, M.A.—This book is intended for the use of students in a training college. The forms provide space for criticism and suggestions on definite points classified under the heads—selection of matter, method, modality, relation of teacher and class. There is also a place for an analysis of the lesson and for the general result of the discussion. In an introduction the author supplies some very sensible remarks on criticism lessons, dwelling especially on the characteristics of justice, thoroughness and fruitfulness. Mr. Scott Coward, H.M. Inspector of Training Colleges, has written a highly commendatory preface.

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Lords of the World. By the Rev. Alfred J. Church. This is an excellent specimen of the serious order of historical romance. It vividly pictures the condition of Carthage just before its final destruction by the Romans, and narrates in realistic style the various stages in its fall. The story takes us also to Alexandria, and describes the fall of Corinth. We have striking glimpses of Scipio the younger, of Mummius the conqueror of Corinth, and a fuller account of Polybius the historian. With the great historic events is woven a record of the adventures of a young Greek whose patriotic spirit leads him to attempt resistance to the might of Rome. But experience of the weakness and unworthiness of those he wishes to aid forces him at length to abandon his purpose with reluctance. The author points out where, for the sake of his story, he has departed from the facts of history. The book is most suitable as a prize for a boy in an advanced class.

A March on London. By G. A. Henty. This is a story of Wat Tyler's insurrection. In his well-known picturesque style the author describes the state of England in the early part of the reign of Richard II., and shows how oppression of the serfs caused growing discontent, which broke out from time to time in riots and rebellions. The story deals specially with the early training and after adventures of two boys, who have a share in many great events, including the suppression of the peasants' rising and the war in Flanders. They conduct themselves bravely in the midst of many dangers, and are knighted by King Richard. Boys will find in this story plenty of interest and excitement.

A Stout English Bowman. By Edgar Pickering. This is a very spirited story of the chivalrous life in the days of Henry III. It gives vivid pictures of the rude warfare which was continually waged by the great barons against each other. The hero, Harold Godwith, who tells the story, is the victim of a cruel baron's hatred. After many exciting adventures and wonderful escapes in England and Guienne, he succeeds in overthrowing his enemy and regains his lost estate. So, besides its other merits, the tale has that of a good ending.

King Olaf's Kinsman. By Charles W. Whistler. This is a story of the last Saxon struggle against the Danes in the days of Edmund Ironside and Canute. As it deals with some events not recorded in the Saxon chronicles, the author has based his narrative partly on some Norse Sagas. It is written in the first person as the story of Redwald, son of Siric, an East Anglian Thane, and the simple style is a pleasing imitation of early English records. The adventures are exciting and such as will delight boyish readers.

Red Apple and Silver Bells. We have nothing but eulogy for this delightful book. Both the author and artist have given us of their best. It is well that the children are so catered for. Some of the verses are better than the others, but all are worth reading. Now and then we get some really exquisite thoughts, as, for instance, 'The Silver Road'—

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> Go straight across the sky,
> And quick as I raced along the shore,
> That quick road followed me,' etc.

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> 'All little children when they die
> Are taken up behind the sky,' etc.

and 'Silver Bells'—

> 'Tis Father Christmas on his way
> Across the winter snows;
> While on his sleigh the silver bells
> Keep chiming as he goes.'

The book is most chastely got up and deserves a wide circulation.

Nell's School Days. By H. F. Gethen. A charming tale, which will appeal powerfully to all girls. The moral discipline of an illness, the power of kindness, the reformation of a street Arab, are well and thoughtfully pourtrayed. The 'New Society for the Correction of Parents' is a particularly happy idea, and parents will derive some hints which may be very necessary as to their relations with their children.

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OUR COMPETITION PAGE

OUR FRENCH PRIZE COMPETITION.

Prize Editor.—W. T. THOMPSON, B.A. (LOND.),
First Class French Honours.

RESULT OF THE OCTOBER COMPETITION.

The prize is awarded to 'Gretchen,' the pseudonym of Mrs. Green, The Vicarage, St. Budeaux, Devonport.

First Class.—Alcantara, Pawn, Celt, Turleum, Couleur verte, Baixe, C.E.M., Southdown, Kirkby, Rosebud, R.F.F., Jean Cottereau, Yussuf, Trot, Brun, Forward, Logos, Fish, Louise, Zimbabwe, Laragh, Sac, Anglo-Saxon, Pointer, Cui bono? Olavian, Victorine, Era, Tomtit, Lily of the Valley, Dolly, Supernumerary, Fertilis, Day Dawn, Peter.

Second Class.—Madelon, Mme. Bouton, Dum spiro spero, Ninoise, Marjory Daw, Sir Bedivere, Mick, Alifer, Nelvil, Nil desperandum, Nortoniensis, Pelican, Red Leaf, A Junior, Treherbert, Brown owl, Salopia, Bothwell, Amor vincit, Sérieux, Carolus, Une Ecossaise, Duffer, Shog, Vincent, Old lamp, White Heather, Château neuf, Persimmon, Vera, La fin, Allons donc! Elspeth, J.S.K., Friar Tuck, Nord, Cæsar, Erin-go-Bragh, Fiddle-de-dee, Campagne, Justicia, Labore et Constantia, Anglaise, Don Quixote, Eleve-maîtresse, Langcliffe, Lebam, Dolores, Cæsarina, E.S., Lily, Espérance, Peggy, Montreux, Wellingtonia, Dorothy Dene, Ignoramus, Erica, Esther, E.C.C., Heath, Spider, Integer, Mathetes.

Third Class.—I.O.U., Tabby cat, Hazard warily, Phoebe, Étudiant, Sanda, Coming, Cynicus, Ebor, En avant, Lilla.

Too late for Classification.—Orkney, Nanou.

Les plaisirs du voisinage n'étaient ni bien vifs ni bien variés. Sophie n'avait qu'un petit nombre de parents éparpillés dans les provinces environnantes, et chez lesquels l'habitude de la crainte, la défiance et l'égoïsme, résultats des révolutions, avaient tué l'amabilité et les réceptions hospitalières. On s'inquiétait fort peu de l'inviter, la simple jeune fille, car elle ne pouvait offrir des amis qui obtinssent une radiation de la liste des émigrés, ou une protection auprès du premier consul, déjà bien grand, déjà bien respectable pour des gens à instinct monarchique. De voisins tels que nous les connaissons, il n'y en avait pas. La noblesse, décimée par la Terreur et par l'émigration, contrainte à se transformer de toutes manières pour échapper à l'attention, était partout, excepté dans ses manoirs La chouannerie, dont le flot était venu mourir aux limites de ce pays, n'aurait pas offert aux nobles compromis ou non, dans ces contrées, l'appui d'une force morale suffisante pour leur permettre de prendre une attitude imposante vis-à-vis de l'autorité ; son existence passée les compromettait sans les pouvoir protéger. Plusieurs générations étaient à la vérité déjà sorties de la bourgeoisie pour dépasser en talent la noblesse comme pour la remplacer en générosité, mais tous ces pauvres du tiers état étaient dans les camps à se battre ou occupés au centre de l'administration à moissonner réputation et fortune. Chaque province s'était donc appauvrie pour payer à l'Etat son tribut de génie. Sophie et probablement beaucoup d'autres femmes de cette région restaient donc seules comme les filles de ce roi grec quand tous les hommes furent allés à la guerre de Troie. J. JANIN.

Translation.

The diversions of the neighbourhood were neither very lively nor very varied. Sophie had only a few relatives, scattered up and down in the surrounding provinces, and with them the habitual fear, suspicion, and selfishness born of revolutions had been fatal to all friendliness and social intercourse. They rarely troubled themselves to invite her to their houses, for she was a mere girl, who had at her disposal no friends influential enough to get a name struck off the roll of Royalist refugees, or to obtain the patronage of the First Consul, even then very great and much respected by people of monarchical tendencies. There were no neighbours, such as we understand by the term. The nobility, their ranks thinned by the Terror and by flight, obliged to disguise themselves in all sorts of ways in order to escape observation, were everywhere except in their own mansions. The Breton insurrectionary wave had spent itself on the confines of this country, and to the nobles of these regions, whether compromised or not, the Chouan party would not have afforded a moral support strong enough to enable them to present a bold front to the authorities ; its past existence endangered their interests rather than protected them. Several generations sprung from the middle class had already, it is true, outstripped the aristocrats in ability, as well as taken their places in liberality, but all these despised plebeians were now fighting on the fields of battle, or else were engaged in reaping fame and fortune at the seat of government. Each province had thus become impoverished in order to pay its tribute of genius to the State. So that Sophie, and probably many other women of this district, were left alone, like the daughters of the Greek king when all the men had gone to the Trojan war. GRETCHEN.

A large proportion of the papers sent in this month did not rise above the level of mediocrity. Whenever this is the case, the difficulties of awarding the prize, and classifying the competitors, is considerably increased. The mediocre character of the majority of the papers accounts for the diminution of the First and Third Classes, and the increase of the Second Class. Some competitors were placed at a disadvantage by not understanding the historical allusions.

Défiance and *égoïsme* are in not a few cases translated by the English words 'defiance' and 'egotism.'

The meaning of the subjunctive in *qui obtinssent* escaped some competitors.

The *local* meaning of *pays* in the phrase *de ce pays* caused some errors.

A moissonner réputation et fortune was taken in an obviously wrong sense by several competitors. 'Cutting down reputation and fortune,' 'ruining reputation and fortune,' 'destroying fame and reputation,' are specimens of erroneous translations

Two competitors insisted on rendering literally the participle in *décimée par la Terreur et par l'émigration.* One translates it, 'cut down to a tenth part of their number' ; the other, 'the nobility put to death every tenth man during the Terror.'

Pour payer à l'Etat son tribut de génie is a pretty obvious metaphor, but some competitors translated it literally, and to make their translations more consistent, took *génie* in its technical sense.

'To pay its annual taxes,' 'to supply its quota of engineers,' 'to pay to the State its engineering tribute,' are examples of what I refer to.

Almost everyone gave a sensible rendering of *tiers état.* I came across two odd renderings in 'third class estate' and 'third class persons.'

NOVEMBER PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract :—

Sous la restauration florissait encore sur les théâtres du boulevard le mélodrame à spectacle et le mélodrame-féerie, genres tout à fait perdus aujourd'hui, et dont il est difficile de se faire une idée, même en se reportant aux chefs-d'œuvre de cet ordre les plus connus. Guilbert de Pixerécourt s'en empara de cette litterature pompeuse pour la civiliser, et par conséquent pour y déposer les premiers germes de destruction. En ce temps peu éloigné encore, il est vrai, mais déjà séparé de nous par tant de faits, le théâtre populaire se proposait un but radicalement opposé à celui qu'il poursuit aujourd'hui : au lieu de chercher à émouvoir l'ouvrier des faubourgs par le spectacle de sa propre vie, au lieu de lui représenter ses poignantes misères de chaque jour, il était la fantaisie qui les lui faisait oublier par des fictions où le merveilleux abondait comme dans les contes de fées et les récits des Mille et une Nuits.

Autant les auteurs cherchent aujourd'hui à atteindre une réalité d'où puissent découler des enseignements, autant alors, se bornant au rôle modeste d'étourdir et de distraire au lieu d'instruire, ils employaient tous leurs efforts à faire vivre le spectateur au milieu des plus étincelantes poésies du rêve. Aussi le côté moral n'était-il représenté dans leur œuvre que par le triomphe complet de la vertu au dénoûment, conclusion aussi éminemment consolante qu'elle est fausse au point de vue humain et religieux, car tout terminer ici-bas, n'est-ce pas démontrer l'inutilité d'une autre vie.

TH. DE BANVILLE.

(*Rules as usual.*)

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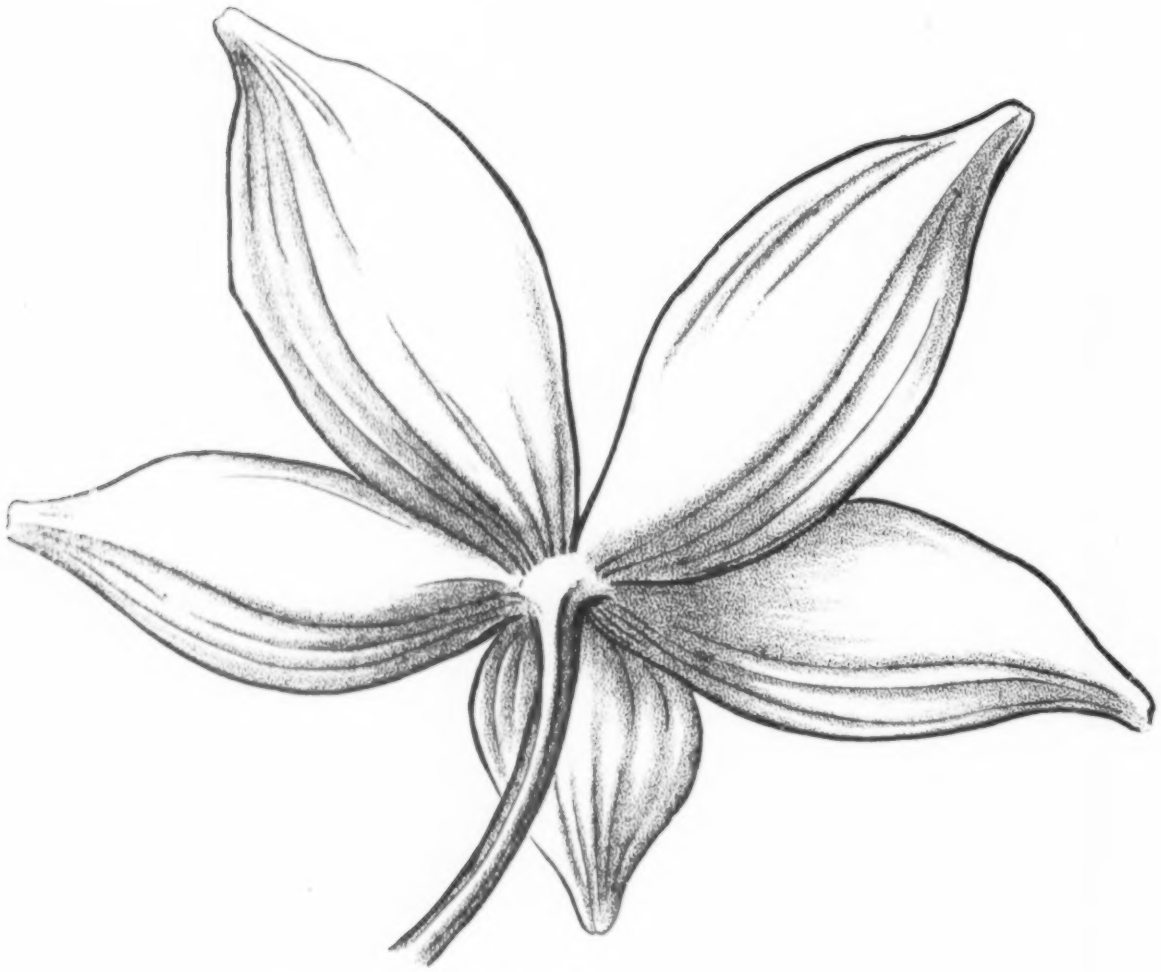

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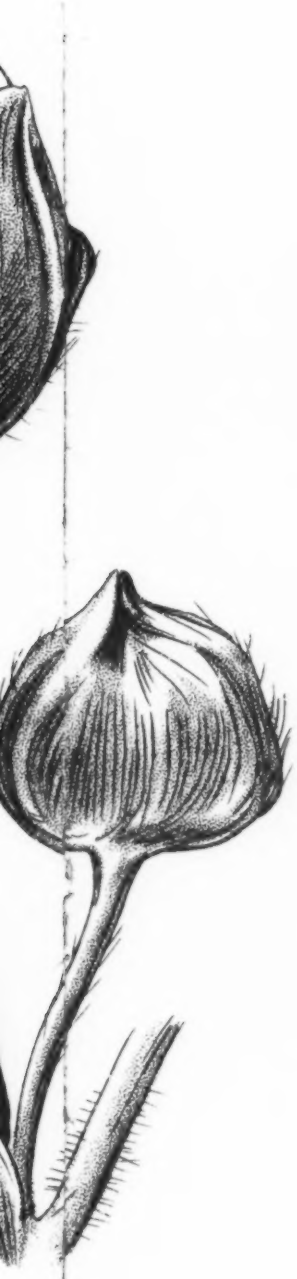

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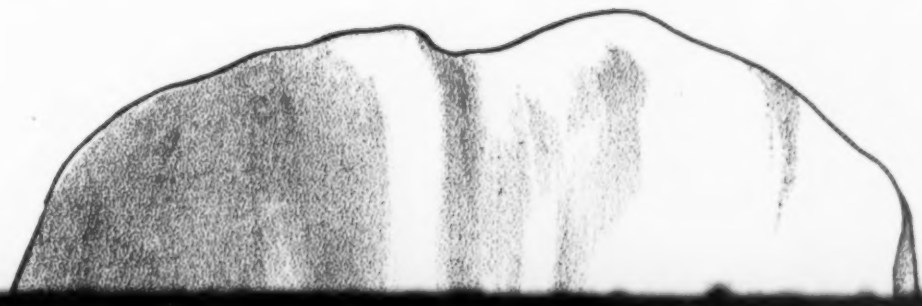

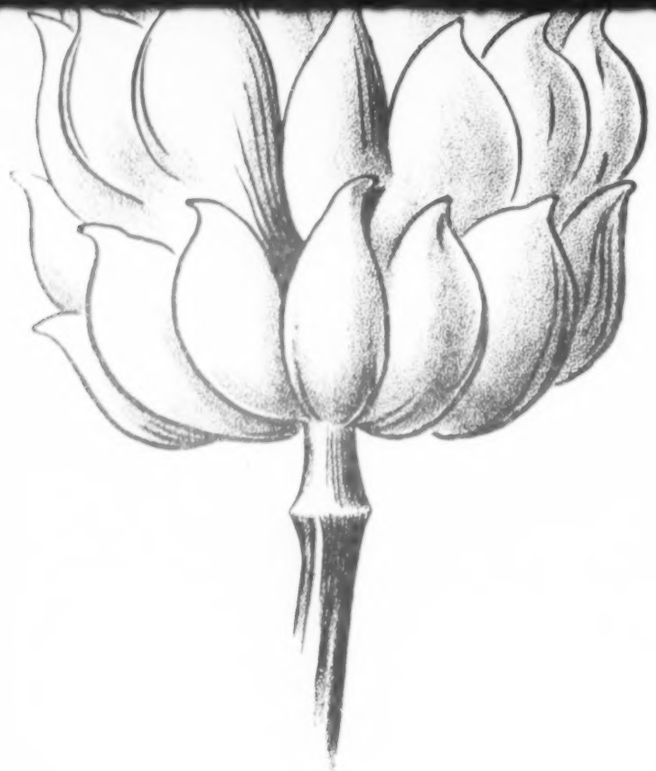

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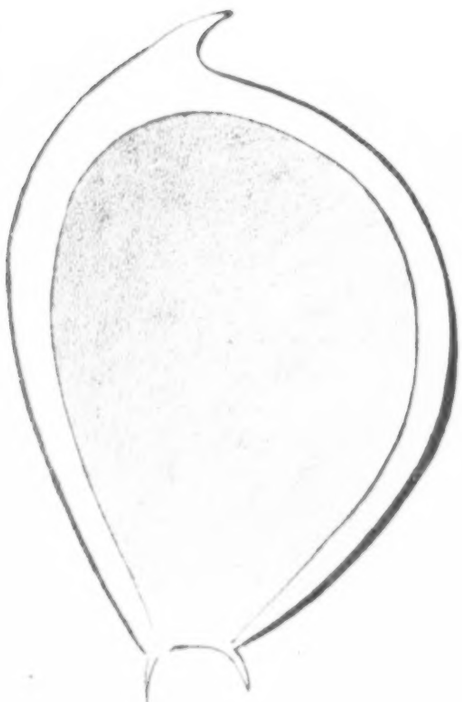

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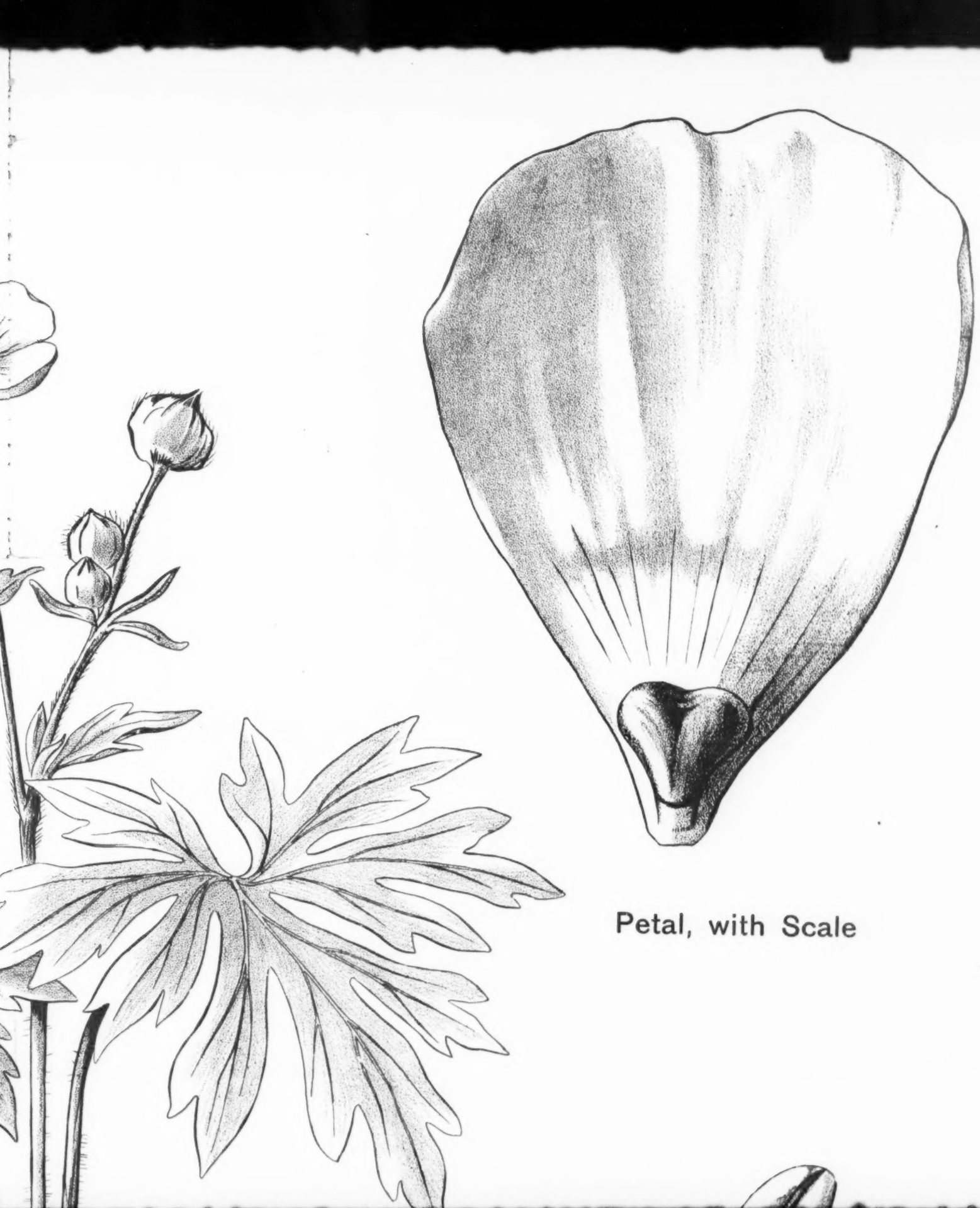

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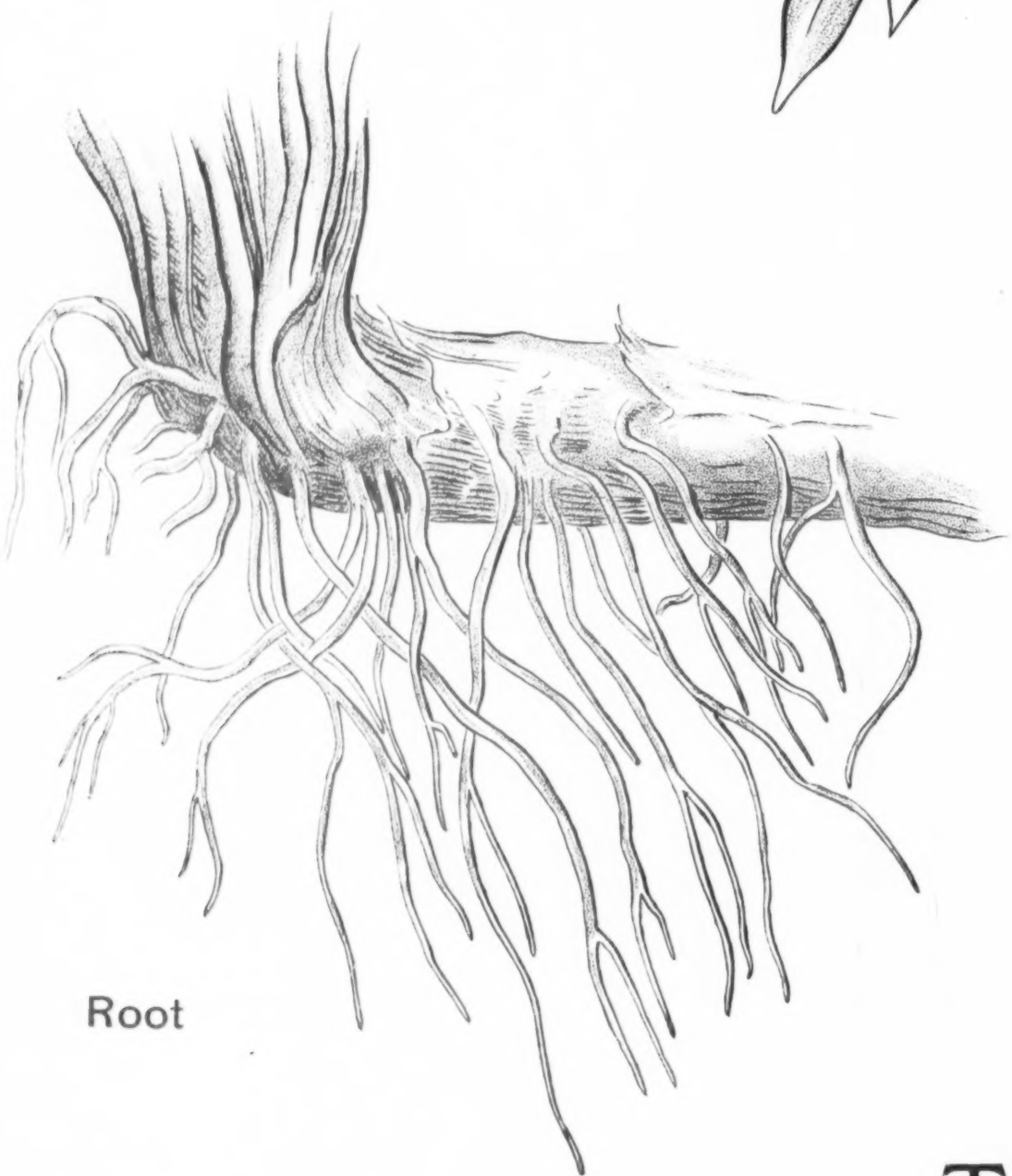

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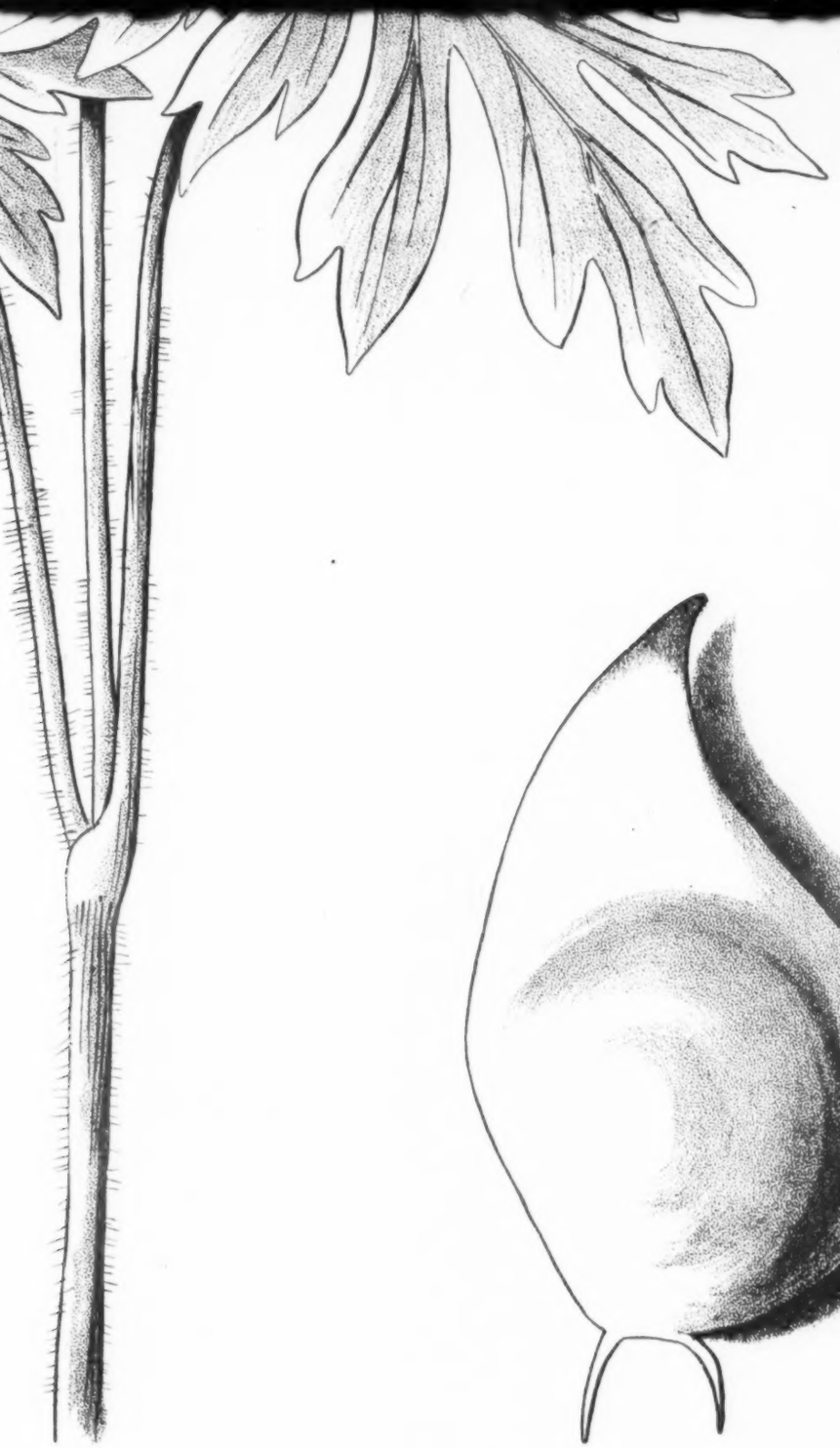

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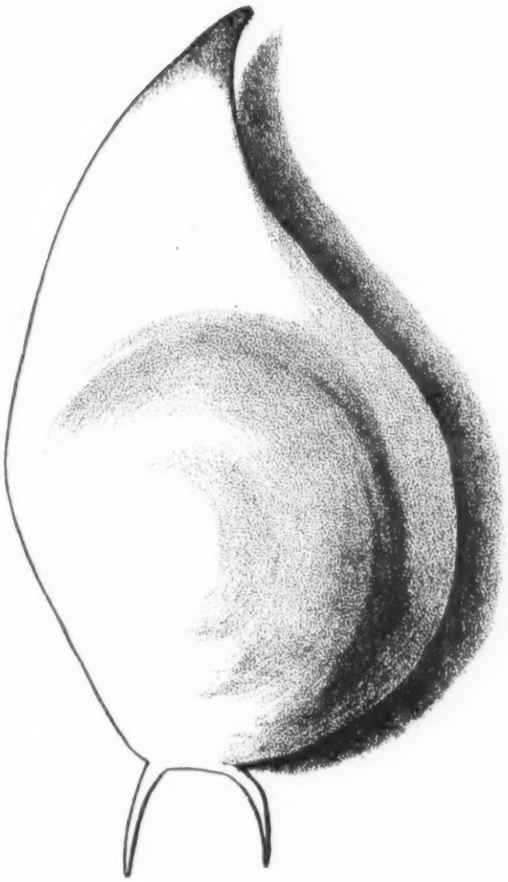

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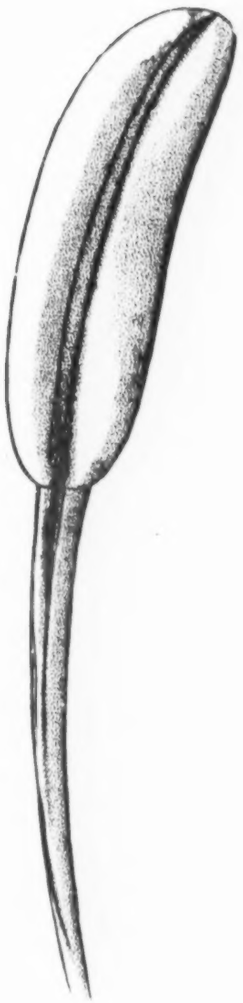

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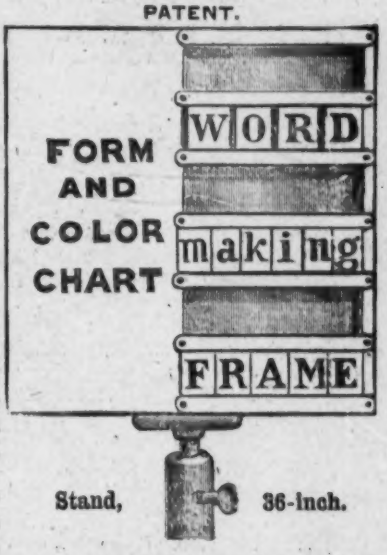

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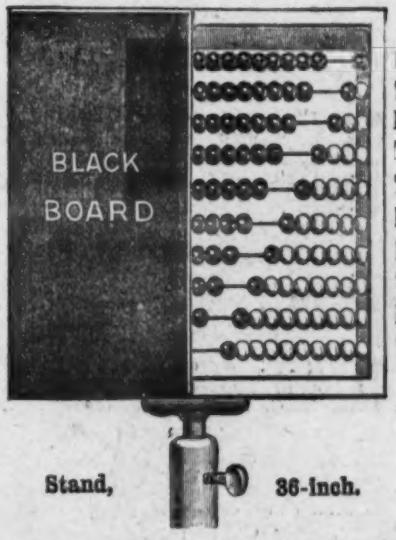

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